**Pacific Northwest
National Laboratory**

Operated by Battelle for the
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**Facility Effluent Monitoring Plan
for the 331 Complex**

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Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

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Pacific Northwest National Laboratory
Richland, Washington 99352

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Environmental Management Services

FACILITY EFFLUENT MONITORING PLAN FOR THE 331 COMPLEX

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Summary

This Facility Effluent Monitoring Plan (FEMP) has been prepared for the 331 Building Life Sciences Laboratory and associated support facilities at the Pacific Northwest National Laboratory (PNNL) to meet the requirements in DOE Order 5400.1, "General Environmental Protection Programs." This FEMP has been prepared for the 331 Complex primarily because it has a "major" (potential to emit > 0.1 mrem/yr) emission point for radionuclide air emissions according to the annual National Emission Standards for Hazardous Air Pollutants (NESHAP) assessment performed. This section summarizes the airborne and liquid effluents and the inventory based NESHAP assessment for the facility. The complete monitoring plan includes characterization of effluent streams, monitoring/sampling design criteria, a description of the monitoring systems and sample analysis, and quality assurance requirements.

The 331 Complex at PNNL houses research in life sciences, materials characterization and testing, and waste management activities. The facility is designed to accommodate the use of radioactive and hazardous materials to conduct these activities. Radioactive material storage and usage occur primarily in the 331 Building with sealed sources and small quantities also in 331G and 331H.

Airborne Effluents

Potential radioactive airborne emissions in the 331 Complex have been assessed and all potential airborne release pathways identified. The primary stack at the 331 Building (EP-331-01-V) is currently registered with the Washington State Department of Health as required by WAC 246-247 *Radiation Protection – Air Emissions*, and is continuously sampled for alpha and beta emitting radioisotopes associated with particulate matter. The stack sampler was designed in accordance with 40 CFR 61. Three other stacks (EP-331-02-S, EP-331G-01-S, and EP-331-02S) are characterized as minor emission points. Chemical inventories were reviewed and determined to be well below the threshold requiring emissions monitoring or development of a risk management plan in accordance with 40 CFR 68.

Liquid Effluents

Liquid effluent release pathways in the 331 Facility are either administratively or physically controlled. Connections, such as floor drains, in the laboratory spaces that have the potential for inadvertent release of chemicals or radioactive material to process sewers have been plugged. The remaining drains have been posted with labels stating the type of drain and liquid effluent disposal controls. These are primarily laboratory sink and hood drains and also some equipment room floor.

The 331 Complex has three sewer systems: the process sewer (PS), the sanitary sewer (SNS), and the Aquaculture system. PS effluent lines from the facility enter into the 300 Area liquid effluent system operated by Waste Management Hanford Company (WMHC). The PS is monitored by WHMC prior to discharge to the Columbia River via the 300 Area Treated Effluent Disposal Facility (TEDF). The 300 Area SNS is monitored, as required, by DynCorp prior to discharge to the City of Richland Publicly Owned Treatment Works (POTW). The Aquaculture System is monitored by PNNL prior to discharge to the Columbia River.

NESHAP Determination

An inventory-based method was used to estimate the maximum offsite dose from potential airborne releases in accordance with 40 CFR 61, Subpart H. The potential unmitigated dose exceeded 0.1 mrem/yr. A number of chemicals in the building in greater than Reportable Quantity, as defined in 40 CFR 302, were identified. This meets both DOE-RL criteria for preparing a FEMP.

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Contents

Summary	i
List of Figures	v
List of Tables	v
Acronym List	vii
1.0 Introduction	1.1
1.1 Purpose	1.1
1.2 Scope	1.1
1.3 Basis for Preparing a FEMP	1.2
1.4 References	1.2
2.0 Facility Description	2.1
2.1 Building Descriptions	2.1
2.1.1 The 331 Building	2.1
2.1.2 The 331-C Building	2.7
2.1.3 The 331-D Building	2.8
2.1.4 The 331-G Building	2.9
2.1.5 The 331-H Building	2.10
2.2 Source Term Definition and Description	2.10
2.2.1 Chemical	2.13
2.2.2 Radionuclide	2.13
2.3 Identification of Effluent Pathways	2.13
2.3.1 Gaseous and Aerosol Emission Pathways	2.14
2.3.2 Liquid Effluent Pathways	2.15
2.4 References	2.17
3.0 Rationale and Design Criteria for Monitoring	3.1
3.1 Basis for Design Criteria	3.1
3.2 Criteria for Radiological Air Emission Sampling and Monitoring	3.2
3.2.1 Sampling System Performance Criteria	3.3
3.2.2 Sampling System Design Criteria	3.3
3.2.3 Sampling System Operation	3.3
3.3 Historical Monitoring/Sampling Data for Effluent Streams	3.5
3.3.1 Normal Conditions	3.5
3.3.2 Upset Conditions	3.9
3.4 Sampling System Description	3.10
3.5 Sampling System Performance	3.13
3.5.1 Stack Radionuclide Sampling System Performance	3.14
3.5.2 Liquid Effluent Sampling and Monitoring	3.14
3.6 Handling of Sampling and Monitoring Data	3.16
3.6.1 Radiological Air-Emission Data	3.17
3.6.2 Aquaculture Outfall Data	3.17
3.7 Calibration and Maintenance of Equipment	3.17
3.8 Alternative Sampling Methods	3.18
3.9 References	3.18
4.0 Laboratory Analyses	4.1
4.1 Analytical Procedures	4.1
4.1.1 Determination of Alpha and Beta Activity on Particulate Air Filters	4.1
4.1.2 Isotopic Analysis	4.1
4.1.3 Liquid Effluent Samples	4.2
4.2 Procedures	4.2
4.3 References	4.3

5.0 Quality Assurance Requirements5.1

5.1 Quality Assurance Plan5.1

5.2 Internal and External Plan Review5.1

5.3 References5.1

6.0 Program Implementation Procedures6.1

6.1 Interface with the Near-facility Environmental Monitoring Program6.1

6.2 Interface with the Operational Environmental Surveillance Program.....6.1

6.3 References6.1

7.0 Reporting7.1

7.1 Routine Effluent Monitoring Reports7.1

7.2 Non-routine Notifications and Reports7.1

7.3 Off-Normal Event Notification and Reporting7.2

7.4 References7.2

Appendix A - Projection of Offsite Emission Dose

Appendix B – Non-radioactive Hazardous Materials Characterization

Appendix C – Supporting Calculations

Appendix D - Ventilation System Flow Pathways

Figures

2.1	Location of the 331 Complex on the Hanford Site.....	2.2
2.2	331 Building First Floor Plan.....	2.4
2.3	331 Second Floor Plan	2.5
2.4	331 Third Floor Plan	2.6
2.5	Simplified Diagram of 331 Building Emission Controls.....	2.7
2.6	331-C Simplified Building Plan	2.8
2.7	331-D Simplified Building Plan	2.9
2.8	331-G Simplified Ventilation Plan	2.10
2.9	331-H Simplified Building Plan	2.11
2.10	300 Area Process Sewer.....	2.16
2.11	Schematic of Aquaculture Discharge System	2.17
3.1	Schematic of 331 Main Stack Sampling System.....	3.11
3.2	Sampling Probe for 331 Main Stack.....	3.12
3.3	331 Main Stack Sampling System Configuration	3.13
3.4	Schematic of the 331 Complex PS Sampling and Monitoring System.....	3.16

Tables

2.1	331 Building Space Assignments.....	2.3
3.1	Estimated Annual Emissions from 331 and 331-H.....	3.5
3.2	Summary of Historical Liquid Monitoring/Sampling	3.6
3.3	Constituents Detected in Building 331 Samples.....	3.6
3.4	Data from Monitoring 331 Aquaculture System.....	3.9
3.5	Off-Normal and Unusual Occurrences in the 331 Complex	3.9
3.6	Detection of Significant Radionuclides in 331 Stack Emissions.....	3.14
3.7	Effluent Requirements for Aquaculture Outfall	3.15
4.1	Isotopic Separation and Analysis Methods.....	4.2

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Acronyms List

AED	aerodynamic equivalent diameter
AMAD	activity median aerodynamic diameters
ANSI	American National Standards Institute
AOP	air operating permit
ASQC	American Society for Quality Control
BCAA	Benton Clean Air Authority
CFR	Code of Federal Regulations
CMS	Chemical Management System
COC	chain of custody
DEPO	Deposition computer code
DMR	Discharge Monitoring Report
DOE	U.S. Department of Energy
DOE/RL	U.S. Department of Energy/Richland Operations Office
EM	environmental management
EMP	environmental monitoring plan
EPA	U.S. Environmental Protection Agency
FEMP	Facility Effluent Monitoring Plan
HEPA	high-efficiency particulate air
HPGE	high purity germanium (detector)
HVAC	heating, ventilation, and air conditioning
LEPD	low energy photon detectors
MBA	material balance area
MDA	minimum detectable activity
MDL	minimum detection levels
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NOC	notice of construction
OED	offsite emission dose
ONE	off-normal event
PNL	Pacific Northwest Laboratory (previous name)
PNNL	Pacific Northwest National Laboratory
PS	process sewer
POTW	publicly owned treatment works
PTE	potential to emit
QA	quality assurance
QC	quality control
RAT	Radioanalytical Application Team
RQ	reportable quantity
SBMS	Standards Based Management System
SNM	special nuclear material
SNS	sanitary sewer
SOP	safe (or standard) operating procedure

SOW statement of work

TEDF Treated Effluent Disposal Facility

WAC Washington Administrative Code

WDOE Washington Department of Ecology

WDOH Washington Department of Health

WHC Westinghouse Hanford Company

WMHC Waste Management Hanford Company

1.0 Introduction

It is the policy of the U.S. Department of Energy (DOE) and the Pacific Northwest National Laboratory (PNNL) to monitor effluents to determine if the public and the environment are adequately protected during DOE operations and whether operations are in compliance with DOE and other applicable federal, state, and local standards and requirements. It is also DOE and DOE-contractor policy that effluent monitoring programs meet high standards of quality and credibility.

1.1 Purpose

DOE Order 5400.1 (DOE 1988), "General Environmental Protection Programs" states the following objective for environmental monitoring programs:

demonstrate compliance with legal and regulatory requirements imposed by applicable Federal, State, and local agencies; confirm adherence to DOE environmental protection policies; and support environmental management decisions (Section IV-1).

Plans must be prepared for each site, facility, or process that uses "significant pollutants or hazardous materials" (DOE 1988, Section, IV-2). These requirements are being met through the environmental monitoring program conducted for the Hanford Site and described by the DOE Richland Operations Office (DOE/RL) in the Hanford Site Environmental Monitoring Plan (EMP) (DOE 1997).

The EMP identifies and discusses two major activities as specified by DOE 5400.1: 1) effluent monitoring, and 2) environmental surveillance. Because the Hanford Site contains a number of facilities with effluent monitoring needs, individual facility effluent monitoring plans (Facility Effluent Monitoring Plans [FEMPs]) are prepared for those facilities to implement effluent monitoring requirements. This report primarily supplies information on effluent monitoring for the 331 Building. Other facilities in the 331 Complex are included in this FEMP because of their close integration with the 331 Building activities and systems. The information provided in this FEMP is current as of the time of FEMP issuance. DOE Order 5400.1 requires the EMP to be reviewed annually and updated every 3 years. Update of this FEMP will also occur on a 3 year schedule.

1.2 Scope

Characterizing the radioactive and nonradioactive constituents in inventory and in waste streams provides the underlying rationale for sampling and monitoring programs. Currently, continuous sampling for radionuclide air emissions is required for the 331 Building main stack because of the radionuclide inventory. Sampling for air chemical emissions is not required for any of the 331 complex facilities.

For liquid waste streams, routine compliance sampling of the 331 Building aquaculture system is required under the Hanford Site NPDES Permit for the aquaculture outfall discharge to the Columbia River. Compliance sampling for the other liquid streams from the 331 Complex (process sewer [PS] and sanitary sewer [SNS]) are incorporated into 300 Area compliance sampling activities conducted by Waste Management Hanford Company (WMHC) for process waste streams and DynCorp, as required, for sanitary discharges to the City of Richland from the 300 Area. PNNL is responsible for ensuring that liquid wastes discharged to these systems meet sewer system waste-acceptance criteria program requirements.

A major activity of the FEMP effort is to identify the liquid and air release pathways (e.g., identify all access points to the various sewers and all radioactive emission release pathways) under normal operations and during process upset conditions. These are verified on as-built drawings that are maintained in PNNL's Essential Drawings System. This verification has been performed for the 331, 331-B, 331-G, and 331-H Buildings for both ventilation ducting and liquid effluent piping and for 331-D for liquid effluent piping only. The 331-C and 331-D Buildings have no forced air ventilation systems and 331-C has no liquid effluent drains.

The method of characterization discussed in this plan identifies potential pollutants at the point of generation and potential upset conditions that are likely to occur, and evaluates the potential for those materials to enter an effluent stream.

1.3 Basis for Preparing a FEMP

A FEMP was determined to be needed for the 331 Building because of the quantity of radionuclides and chemicals in the building. The 331 Building has a potential to emit (PTE) of >0.1 mrem/yr for radionuclides and has numerous chemicals in excess of their Reportable Quantity (RQ) value. This meets both DOE-RL criteria for the preparation of a FEMP. A list of radioactive material in the facility can be found in Appendix A and a list of chemicals in greater than the RQ is provided in Appendix B. Additionally, routine liquid effluent monitoring is required for discharges from the 331 Building Aquaculture Outfall.

1.4 References

DOE 1988. *General Environmental Protection Program*, DOE 5400.1. U.S. Department of Energy Order. U.S. Department of Energy, Washington, D.C.

DOE 1997. *Environmental Monitoring Plan*, DOE/RL-91-50, Rev 2, United States Department of Energy, Richland Operations Office, Richland, Washington.

2.0 Facility Description

The 331 Complex is located in the 300 Area of Hanford (see Figure 2.1) and currently consists of the following buildings: 331, 331-B (inactive), 331-C, 331-D, 331-G, and 331-H. The 331 Building was constructed in 1970 for biological and botanical research. Associated buildings (331-A to 331-J) were constructed during the 1970s for specialized support functions. Many of the support buildings have assumed new functions over the years as research needs changed, and several buildings have been vacated and torn down. However, work in the main research facility (331) continues, and the radiological inventory has increased with the closure of other PNNL-operated 300 Area facilities so that continuous monitoring for radiological airborne emissions is now required.

2.1 Building Descriptions

Descriptions are provided for the main 331 Building and active remaining support buildings, including physical and process descriptions.

2.1.1 The 331 Building

Activities

One of the primary functions of the Life Sciences Laboratory (331 Building) is to provide research capabilities to study the health effects of chemicals and radiation, and the uptake and transformation effects in soils, plants, animals, microorganisms, and solutions when they are exposed to radiation. Current projects are being conducted to examine these effects in animals (rodents) and in cells grown in culture. Much of this work focuses on molecular level changes and uses very small amounts of radioactive materials for tracing biological molecules. Studies are conducted to:

- Understand molecular and cellular processes resulting from insult by physical and chemical agents. This work is to provide data that serves as a basis for precise cross-species and low-dose extrapolation of health risks and to supply information to understand disease mechanisms, levels, and effect.
- Develop a fundamental understanding of the specific geochemical reactions that occur in aqueous solutions and between aqueous solutions and solid/gas phases.
- Materials characterization and testing.
- Determine dose-response relationships for various health endpoints and the mechanisms of effects from electromagnetic frequency exposure and lightweight magnetic shielding materials.
- Study microorganisms and/or their processes in various environments. Research emphasis is currently in subsurface microbiology, including the physiology and ecology of subsurface microorganisms, degradation of organic contaminants, bioremediation, enzymatic reduction of metals, and biogeochemical cycling of nutrients.
- Investigate macromolecular structure and dynamics and probe the consequences of observables on molecular function. The structures under study include:
 - nucleic acid sequences chosen to model radiation (or chemically) damaged DNA
 - RNAs and their various complexes
 - epidermal cells and mammary cells to study the effects of tumor formation
 - transient species generated via oxidative processes in biological systems
 - metalloproteins that can concentrate or detoxify pollutants from the environment
 - clays, oxides, and metals supported on oxide surfaces with or without adsorbates.

An outcome of this research program activity is the development of instrumentation and analytical methods that are applied in an innovative manner to facilitate a new level of understanding of structure and function that can be applied to other important research initiatives.

Figure 2.1 Location of the 331 Complex on the Hanford Site

Another function of the 331 Building is to provide aquaculture research capabilities. Aquaculture research conducted in the 331 Building provides an integrated approach to characterizing and monitoring aquatic ecosystems by developing and deploying new technologies and methods. Research focuses on the impacts of water-use practices on fisheries and the response of the aquatic ecosystems to engineered structures and to natural and man-induced stresses. Examples of aquaculture studies are:

- Biological tests on fish in support of a Corp of Engineers Gas Abatement Program. Results of the tests are used to select alternatives for redesigning the lower Snake and Columbia River dams to bring operations into compliance with state and U.S. Environmental Protection Agency (EPA) water-quality standards for saturated gas.
- Experiments related to natural resource damage assessments, hyporheic flow, and mechanisms of contaminant uptake.

The facility is also equipped with a cobalt irradiator that is used for a wide variety of exposures from cell cultures to food.

Additionally, research work in the 331 Building is conducted to promote an understanding of the chemical and biological processes that govern the mobility and degradation of a range of inorganic, organic, and radioactive contaminants in soils, sediments, and groundwater systems. This work may use radioactive materials in more significant quantities.

Finally, research in the 331 Building is conducted to obtain measurements of exposures to physical and chemical agents. This includes associated research to interpret and validate measurements for providing customers with more accurate and relevant information on worker and public exposures and to provide assistance in radioisotope technology to the medical community for diagnosing and treating diseases.

Physical Description

The 331 Building physical structure consists primarily of two laboratory floors with a mechanical-electrical service floor sandwiched in between. Blending into the building to the west and north is additional single-story laboratory space. Extending from the west end of the building are two wings extending south that were animal kennels. The administrative office area is a three-story building with a two-story addition on the northeast side of the building. Figures 2.2 through 2.4 provide floor plans of the 331 Building, and Table 2.1 lists the building-space assignments.

Table 2.1 331 Building Space Assignments

Description	Dimensions
Office Space	14,000 ft ²
Laboratories	37,500 ft ²
Common	63,100 ft ²
Storage	500 ft ²
Total Area	115,100 ft ²

The 331 Building has a 400-ton compressor unit on the roof and 200-ton compressor for zone cooling in the equipment room (Room 100). The ventilation system is able to maintain 15 to 20 air changes per hour in the animal quarters and 4 changes per hour in the office spaces. High-efficiency particulate air (HEPA) filtration is provided in areas where work with radioactive materials is performed. As shown in Figure 2.5, these areas include the inhalation suite on the first floor, fume hoods in the animal rooms on the third floor, and glove boxes and fume hoods in rooms 101 through 107.

Utility services for the 331 Building include hot, cold, process, sanitary, and deionized water; sanitary sewer, PS, and aquaculture system; cage washers; compressed air; laboratory vacuum; steam; and electrical (two 2000 kVA transformers provide normal power, and one 500 kVA transformer provides emergency power). Safety/emergency equipment installed in the building includes safety showers, eyewash stations, fire extinguishers, fire alarms and suppression, and storage cabinets for flammables.

Figure 2.2 331 Building, First Floor Plan

Figure 2.3 331 Building, Second Floor Plan

Figure 2.4 331 Building, Third Floor Plan

High Efficiency
Air Particulate
(HEPA) Filter

980800087.19

Figure 2.5 Simplified Diagram of 331 Building Emission Controls

2.1.2 The 331-C Building

The 331-C Building, previously known as an Animal Care Facility Storage, is used as general warehouse space to store government standard furniture and research equipment for future use. This facility also has a satellite accumulation area for hazardous waste and a storage area outside for low-level waste. Some maintenance staff have office space in the building.

The 331-C Building is a Butler building, 100 ft by 50 ft, erected on a concrete slab south of the 331 Building (see Figure 2.6). All 5,000 ft² is considered storage or common space. The building is heated with electric space heaters, but has no forced air ventilation. No process water supply or liquid effluent piping or drains are provided. Electrical service is provided with a 125-amp main power supply. Safety/emergency equipment installed in the building includes fire extinguishers, fire alarm, and suppression systems.

Figure 2.6 331-C Simplified Building Plan

2.1.3 The 331-D Building

The 331-D Building, which was used in the past as a biomagnetic effects laboratory, is used to store equipment and supplies, including portable samplers, pH meters, bottles, buffer solutions, and concentrated dyes in support of PNNL- and Battelle-compliance monitoring activities. Non-radioactive wastewater samples are temporarily stored before shipment to various analytical laboratories. Additionally, chemicals used in facility and 300 Area mechanical systems are stored in a back room for PNNL Maintenance Services Organizations.

The 331-D building is a semi-high bay, prefabricated, metal Butler building erected on a concrete slab to the southeast of the 331 Building. The structure is approximately 42 ft by 32 ft and was originally built as an animal-waste treatment facility. It was converted in 1977 to a biomagnetic effects laboratory where electromagnetic field studies were conducted on rats (Gerber 1992) and currently is used primarily by PNNL's Effluent Management Group to store effluent sampling and monitoring equipment and also by 300 Area Maintenance Services to store bulk chemicals used in various mechanical systems throughout the 300 Area. It has three large rooms, one of which is equipped with a sink, cabinets, and a counter top. This room, with about one-third of the floor space, is considered wet and dry lab. The other two rooms, which constitute the remaining two-thirds of the 1300-ft² total floor space, are considered storage. Figure 2.7 is a simplified building plan.

Building heat is supplied with three small ceiling-mounted electric space heaters and cooled with two 24,000-BTU, wall-mounted air conditioning units. No forced air ventilation is provided. Building services include water supply, PS, and electrical (112.5 kVA main transformer/480V, 208V, and 120V available). Safety/emergency equipment installed in the building includes an eyewash station and fire extinguishers.

Figure 2.7 331-D Simplified Building Plan

2.1.4 The 331-G Building

The Interim Tissue Repository (331-G Building) provides research capabilities for conducting radioactive tracer studies using animals, biota, vegetation, and soils. In the main 331 Building, small quantities of tracer radionuclides are deposited in soil, taken up by vegetation, and fed to small animals. In the 331-G Building, some of these animals may be temporarily housed and their excrements stored in closed containers.

The 331-G Building is a 60-ft by 20-ft concrete block structure on concrete slab located to the extreme southeast of the 331 Building. The building was originally built to house laboratory animals (primarily swine) while they were giving birth, but is now used in support of animal research. Almost all of the 1200 ft² are considered dry laboratory.

The 331-G Building has two emission points. Ventilation from a laboratory fume hood is exhausted through a roof stack, and the balance of the 331-G room air is exhausted through a stack located north of the facility. A single HEPA filter is installed at each stack. Figure 2.8 shows a simplified architectural building plan and existing stack locations.

36000037 22

Figure 2.8 331-G Simplified Ventilation Diagram

2.1.5 The 331-H Building

In the Aerosol Wind Tunnel Research Facility (331-H Building), research is conducted to evaluate the effects and changes in plants, animals, and the surface geologic materials occurring as a result of airborne deposition of windblown materials, chemical constituents, or wind erosion. The facility houses a wind tunnel, associated measurement equipment, and a lab area to perform these studies.

The 331-H Building is a one-story concrete block structure on concrete foundations and a concrete slab southeast of the 331 Building (see Figure 2.9). The building has a flat, built-up roof covered with gravel. A metal lean-to is attached to the northwest corner of the building to provide additional research space. A little over half of the 3600-ft² floor space is considered dry or wet laboratory; the remainder is considered common space.

Building heat is supplied with electric resistant heat coils and a ceiling-mounted electric space heater and cooled with a 15-ton air conditioner. Outside air is drawn into the building through a roof-mounted heat pump and exhausted through a two-stage HEPA filter to a stack. The wind tunnel draws air from the room and exhausts it with the room exhaust through the HEPA filters to the stack. Building services include compressed air, laboratory vacuum, process water, sanitary sewer, PS, and electrical (150 kVA main transformer plus 55 kW propane-fueled emergency generator with 227/480V). Safety/emergency equipment installed in the building includes safety shower & eye wash stations, fire extinguishers, fire alarm and suppression systems.

2.2 Source Term Definition and Description

The characteristics of releases that could contribute to each effluent stream during normal operating and upset conditions are described in this section. Unconfined contact with ventilation air or unrestricted flow path to a sewer is the only prerequisite for an inventory to contribute a source term to an effluent stream. Thus, all "passive" inventories stored in open containers, as well as those undergoing sparging, boiling, pouring, and other "active" processes, can potentially produce gas or aerosol source terms. The following subsections discuss potential source terms under normal and upset^(a) conditions.

(a) The Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (U.S. Department of Energy 1991) states that "provisions for monitoring of airborne emissions during accident situations should* be considered." The term "upsets" is used in this document to refer to accidents that might

Footnote continued on next page

Figure 2.9 331-H Simplified Building Diagram

Normal Operations

The types of operations performed in each of the 331 Complex facilities are described in Section 2.1. For the 331 Building, these are primarily laboratory research experiments involving soils, plants, animals, microorganisms, and solutions. Air and liquid effluents from these activities could occur from storage and handling, sample preparation, experiments, and use of instrumentation. These emissions are considered small compared to pilot-scale or full-scale processes and can contain a variety of chemical or radioactive components.

Under normal operations, a risk evaluation is performed before starting new research projects. Part of this evaluation is to identify any environmental issues, including the release of hazardous, toxic, or radioactive effluents. At the evaluation stage, a determination is made on the need for additional effluent controls and for a notice of construction (NOC) for air emissions that may fall outside of the facility-permitted operations. For expanded or modified research projects, the Standards-Based Management System (SBMS)^(a) Subject Area, Airborne Emissions (SBMS, Airborne Emissions), provides requirements and guidance on determining whether additional controls or notification is required for airborne emissions. Liquid effluents may also be considered before project start up if the effluents pose special challenges. However, the disposal of liquid effluents is generally determined using a discharge approval process after the wastewater has been generated.

Activities with a potential to emit radioactive materials are performed in laboratories provided with HEPA filtration that exhaust to the 331 main stack. Under normal operations, these emissions are continuously sampled at the main stack and analyzed for total alpha and total beta activity. Activities involving chemicals are also performed in laboratories generally equipped with fume hoods and sinks. Air chemical emissions are primarily exhausted from the main stack, but may also be exhausted via the animal

be expected to occur in a facility and for which monitoring should be considered.

(a) SBMS provides staff with Laboratory-wide standards, procedures, and guidelines for the work they perform. The Laboratory develops standards, procedures, and guidelines based on an evaluation of external requirements documents, including orders, directives, and federal, state and local laws, as well as Battelle policy.

exhaust or a system that was originally installed for radon inhalation research that was never initiated. The 331 facility operates under a WDOH permit (97NM-147, 11/10/1997) for chemical air emissions, and sampling or monitoring of chemical air emissions is not required.

Under normal operating conditions, the Sanitary Sewer System (SNS) only receives effluent from the restrooms, water fountains, lunchrooms, and change rooms. No radioactive or hazardous chemical source terms are normally released through this pathway. Nor does the PS, which serves laboratory areas, normally contain radioactive material or regulated hazardous material. Laboratory generated liquid wastes undergo a discharge approval process before discharge to the PS.

The current normal operations do not call for monitoring or sampling the 331 Complex SNS or PS effluent. However, the PS is equipped with a monitoring/sampling system to investigate or characterize discharges from the building when needed. The SNS can be sampled with a portable sampling system if needed.

The 331 Building aquaculture system serves the aquatics laboratory in the 331 Building. In addition, some storm water drains on the roof of the 331 Building are also connected to the aquaculture system. Discharges to this system are limited to pollutants normally found in fish-hatchery discharges. Chemicals used for experimental purposes are not discharged. The aquaculture system is routinely monitored as required by National Pollutant Discharge Elimination System (NPDES) Permit WA-000374-3 (EPA 1987).

The 331 Building is the primary source-term contributor to effluent pathways. Other 331 Complex support buildings contribute little or no effluent discharges. The 331-C Building is used primarily for storage and does not have any air or liquid effluents under normal operations. Similarly, activities in the 331-D building are primarily storage, although some insignificant quantities of air and liquid effluents may be generated from the effluent-management support laboratory. Research work in 331-G and 331-H may also generate small quantities of air or liquid effluents under normal operations. The liquid effluent discharge approval process is followed for liquid effluents, and no sampling is required for airborne emissions.

Upset Conditions

Section 3.5.2 discusses upset conditions that have been classified as off-normal or unusual occurrences. Upset conditions that could affect air or liquid effluents are primarily spills of hazardous materials. Although some air emissions are generated from spills, they are minor because chemicals are generally handled in small quantities in the research laboratories, and only a small fraction of the material spilled is made airborne (unless the chemical is extremely volatile). The greater environmental hazard from spills is the potential for release to a sewer system. An SBMS Subject Area (SBMS, Spill Response) gives PNNL staff requirements for training and for responding to a spill. Another Subject Area (SBMS, Managing Liquid Effluents) gives requirements on labeling liquid-effluent access points. Liquid-effluent monitoring is performed as needed to respond to spills.

Upset conditions can also disrupt facility ventilation. As shown in Section 3.5.2, power outages sometimes resulting in loss of ventilation have occurred. Also, radiological air sampling-system equipment may fail, disrupting the effluent measurements. Interruptions in the required continuous sampling for the 331 Building are minimized by maintaining critical backup components and providing frequent inspections of the sampling system. The effect of interruptions or other sampling concerns are documented and correction factors determined by Effluent Management when necessary. The other 331 Complex facilities (331-C, 331-D, 331-G, and 331-H) are not required to be sampled, so ventilation upsets in these facilities do not affect air-emission sampling.

Sampling for liquid effluents is periodic for the 331 Building, and loss of power or sampling equipment malfunctions is not considered critical. The sampling period can be adjusted or a discrepancy report completed to identify and correct for the effect on the air or liquid effluent measurements taken. No air- or liquid-effluent sampling is required for the other 331 Complex facilities.

2.2.1 Chemical

Chemical storage and usage are well dispersed throughout the laboratory spaces of the 331 Complex and consist primarily of small-volume chemicals and standards used in conducting laboratory experiments with some larger volumes. Appendix B provides a summary of the quantities of hazardous chemicals with an RQ in the 331 Complex. Most of these chemicals are distributed throughout several laboratories. All chemicals within the facility are inventoried and tracked via the Chemical Management System (CMS) (SBMS, Working with Chemicals). A few chemicals in the facility exceed the RQ specified in EPA (1997). These chemicals are highlighted in Appendix B.

Many of the laboratories contain satellite accumulation areas for liquid and solid hazardous wastes. An active inventory of the waste contents is maintained in the satellite areas. Liquid and solid wastes are disposed of in accordance with guidelines described in the SBMS (SBMS, Managing Liquid Effluents and Managing Nonradioactive Chemical Wastes).

2.2.2 Radionuclide

Radioactive-material storage and usage are dispersed throughout the 331 Building and include a large number of isotopes. These materials are found in several forms, including solid, liquid, particulate, and gas. Some of these materials may also be heated during testing, producing vapors. No radioactive materials are in 331-C and 331-D; 331-G may periodically have trace quantities of radioactive materials from animal experiments; 331-H has sealed sources only.

A current inventory for each building is assessed annually to determine radiological air-emission sampling requirements. The inventory list is a combination of the following three lists:

- Part 1 - Inventory Estimates provided by 331 staff, which is any radionuclide material that is not included in the Part 2 or Part 3 inventories
- Part 2 - Composite Radioactive Material Inventory, which contains data on sealed sources that are assigned to custodians and accounted for by PNNL Health and Safety Department
- Part 3 - Nuclear Materials Inventory, which is the inventory of special nuclear material (SNM) that is maintained in a material balance area (MBA) and assigned to an MBA custodian.

The assessment methodology is documented in Ballinger et al. (1995). Appendix A provides information on the types of radionuclides found in each facility in the 331 Complex.

2.3 Identification of Effluent Pathways

Effluent pathways and their facility points-of-discharge of liquid and airborne effluents from the 331 Complex are described in the following sections.

The term "point-of-discharge," as used in this chapter, refers to the point at which the effluent leaves PNNL control. For airborne emissions, the discharge point coincides with the point of effluent entry into the uncontrolled environment. Thus, "discharges" of airborne emissions must comply with DOE, U.S. Environmental Protection Agency (EPA), and Washington State Department of Health (WDOH) emission control and monitoring requirements. The aquaculture system, which discharges into the Columbia River, also enters into the environment when it leaves PNNL control. Thus, aquaculture discharges must comply with EPA NPDES control and monitoring requirements. SNS and PS liquid effluents originating in the 331 Facility, on the other hand, remain in a controlled system at the "point-of-discharge." At these points, the responsibility for the effluent stream, including its ultimate disposition, passes from PNNL to the site-operations contractors, Waste Management Hanford Company (WMHC) and DynCorp. As such, they are responsible for monitoring and controlling environmental discharges of liquid effluents from these systems. However, PNNL is responsible for characterizing effluents originating in its facilities and for

exercising appropriate control over these effluent sources. Therefore, PS sampling and monitoring capabilities are maintained at 331 to use when needed to characterize or investigate liquid effluents from these systems.

The 331 Complex produces both liquid and gaseous effluent streams, all of which are generated in the buildings rather than being pass-throughs from other facilities. The effluent streams during normal and shutdown operations include three sewer systems and individual airborne emission points from 331, 331-G, and 331-H. The 331-C and 331-D Buildings have no forced-air ventilation systems, so airborne emissions from these facilities are considered fugitive emissions.

2.3.1 Gaseous and Aerosol Emission Pathways

The 331 Building exhaust system diagrams can be found in the schematics in Appendix D. The detailed drawings were prepared in 1998 and have been identified as "essential drawings." Any facility modification that changes building flow paths 1) must receive prior concurrence of the building manager (per PNL-MA-8 [PNNL 1997]), and 2) requires updating of the appropriate drawing before project close-out. The PNNL SBMS Subject Area "*Creating or Modifying Engineering Calculations, Drawings, and Specifications*" (SBMS, Creating or Modifying Engineering Calculations, Drawings, and Specifications) gives the requirements for controlling facility modifications.

As shown in the Appendix D drawings, the 331 Building is complex with multiple ventilation systems. The main system has four supply fans that operate two at a time; two operating and two on standby. One of the operating fans provides 100% outside air, and the other provides some recirculated air from office areas and lab room exhausts. Supply air is drawn through office and laboratory areas and exhausted through the main system ductwork to a rooftop stack. Gloveboxes, fume hoods, and chambers obtain supply air from the surrounding rooms and may exhaust through single or double HEPA filters before exiting the stack.

The animal ventilation system is supplied by two fans separate from the main system. One of the fans is operated at a time and draws 100% outside air. Laboratory areas served by this system are all on the first floor and include several rooms on the west end of the building and most of the north wing. Exhaust air is unfiltered and emitted through a separate stack.

Another exhaust system was originally installed for radon inhalation research, but the research was never initiated due to funding changes. This system serves the labs on the extreme west end of the building and has its own supply and exhaust system. The exhaust is not filtered and exits a roof top stack. The office wing on the northeast side of the building also has an independent ventilation system with heat pumps supplying heating and cooling.

The 331G Building obtains supply air from a supply fan that draws in outside air. A fume hood inside the building draws in room air and exhausts through a HEPA filter to the roof. Building air is also exhausted through a HEPA filter, but through a separate stack. Figure 2.8 is a schematic.

The 331-H Building ventilation system draws air in from the outside and exhausts it through a two-stage HEPA filter to a stack. Ventilation for the wind tunnel is provided from the room air and exhausted to the room air ducting.

Most of the air vents in the 331 Complex facilities are part of the ventilation exhaust system, except for the sewer-system vents. A listing of vents and stacks from the 331 Complex facilities was compiled by PNNL's Effluent Management Group and is being updated as resources allow. The 331 Building has a large number of vents; 331-G and 331-H have a small number; 331-C and 331-D have no airborne emission points.

2.3.2 Liquid Effluent Pathways

Liquids effluents are discharged from the 331 Complex Facilities via three primary liquid-waste systems: the SNS, the PS, and the aquaculture system. The 331-C Building does not have access to any of the sewer systems.

Sanitary Sewer

The SNS receives effluent from only the restrooms, lunchroom, change rooms, some cooling processes, and other water uses in which no contamination is believed to be possible. Under normal operating conditions, no regulated materials are present in the SNS effluent. The sanitary wastewater is discharged into the 300 Area SNS, operated by DynCorp under contract with DOE. The 300 Area SNS discharges to the City of Richland Publicly Owned Treatment Works (POTW) under a contract agreement between DOE and the City. Both the 331 and 331-H Buildings have access to the SNS.

Process Sewer

The PS receives process wastewater, such as equipment cooling water, effluent from cage washers, and laboratory wastewater, from the 331 Complex facilities. The PS discharges to the 300 Area PS System that flows to the Treated Effluent Disposal Facility (TEDF) before being discharged to the Columbia River. The 331, 331-D, 331-G, and 331-H Buildings have access to the PS. Figure 2.10 is a schematic of the 300 Area PS.

Aquaculture System

The aquaculture system was developed to support aquaculture research in the 331 Building, and only the 331 Building is served by this system. The aquatics laboratory uses both river and well water sources for supplying water for fish-rearing activities. Effluents are discharged to the Columbia River. In addition to aquaculture operations, storm water from the southern half of the 331 Building rooftop also contributes to the outfall discharges. Figure 2.11 is a schematic of the aquaculture discharge system.

Figure 2.10 300 Area Process Sewer

Figure 2.11 Schematic of Aquaculture Discharge System

2.4 References

Ballinger, M. Y., S. J. Jette, and M. J. Sula. 1995. *Assessment of Unabated Facility Emission Potentials for Evaluating Airborne Radionuclide Monitoring Requirements at Pacific Northwest National Laboratory – 1995*. PNL-10855, Pacific Northwest National Laboratory, Richland, Washington.

EPA 1981. *National Pollutant Discharge Elimination System Permit*. NPDES WA-000374-3. U.S. Environmental Protection Agency. Washington D.C.

EPA 1997. *Reportable Quantities*. 40 CFR 302.4. U.S. Code of Federal Regulations. U.S. Environmental Protection Agency. Washington D.C.

Gerber, M. S. 1992. *Past Practices Technical Characterization Study – 300 Area – Hanford Site*. WHC-MR-0388, Westinghouse Hanford Company, Richland, Washington.

PNNL 1997. *Waste Management and Environmental Compliance*. Standards-Based Management System A-Manual PNL-MA-8 (<http://sbms.pnl.gov:2080/amanuals/ma08/a008t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS Airborne Emissions. 1998. *Airborne Emissions*. SBMS Subject Area (<http://sbms.pnl.gov:2080/standard/0g/0g00t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS Chemical Handling. 1997. *Working With Chemicals*. SBMS Subject Area (<http://pnl.gov:2080/standard/03/0300t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS Creating or Modifying Engineering Calculations, Drawings, and Specifications. 1997. *Creating or Modifying Engineering Calculations, Drawings, and Specifications*. SBMS Subject Area (<http://sbms.pnl.gov:2080/standard/91/9100t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS Managing Liquid Effluents. 1998. *Managing Liquid Effluents*. SBMS Subject Area (<http://sbms.pnl.gov:2080/standard/0q/0q00t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS Spill Response. 1995. *"Spill Response."* SBMS Subject Area (<http://sbms.pnl.gov:2080/standard/0e/0e00t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

3.0 Rationale and Design Criteria for Monitoring

This section discusses design criteria for the 331 Complex effluent measurement program. Criteria are established to ensure that effluent measurements are performed according to applicable regulations and guidance and are appropriate for existing facility operations.

In this section, the terms "sampling" and "monitoring" are used to distinguish between two types of airborne-emissions measurement processes:

- "Sampling" refers to collecting a representative portion of the emission over a period of time, with subsequent analysis for constituents of interest. "Sampling" is an "after-the-fact" measurement.
- "Monitoring", on the other hand, is measuring radionuclide emission rates by means of a detector located in the sample stream. "Monitoring" is a "real-time" measurement.

Airborne and liquid-effluent sampling is performed to demonstrate compliance with emission standards, to identify emission trends, and to provide evidence regarding the effectiveness of emission-control systems. Effluent sampling may also be performed to characterize waste streams or investigate discharges of concern.

Effluent stream monitoring is performed as a means to provide timely indication of a significant change in emission rate. Currently, monitoring is only required for the 331 aquaculture discharge. Although not required for compliance, a liquid-effluent monitoring system is provided in the 331 Complex at a location downstream of PS discharges from 331, 331-D, 331-G and 331-H. This system is used as a tool to investigate potential problematic discharges.

Currently, radiological air sampling and liquid effluent sampling are required at some of the 331 Complex waste streams. The sections below give the bases, criteria, and descriptions of compliance sampling systems and operations.

3.1 Basis for Design Criteria

The following regulations, DOE Orders, and guidance were considered in effluent sampling and monitoring system design and operation:

Regulations on Standards of Performance for New Stationary Sources, Appendix A: Reference Methods. Environmental Protection Agency, U.S. Code of Federal Regulations, 40 CFR 60. (EPA 1971)

National Emission Standards for Hazardous Air Pollutants. Environmental Protection Agency, U.S. Code of Federal Regulations, 40 CFR 61 (EPA 1990).

National Pollutant Discharge Elimination System (NPDES) Permit, No. WA-00374-3 (EPA 1981).

National Pollutant Discharge Elimination System Permit Regulations. Environmental Protection Agency, U.S. Code of Federal Regulations, 40 CFR 122. (EPA 1983)

Hanford Site Air Operating Permit. Washington State Department of Ecology and Washington State Department of Health. HNF-AOP-97-1 (WDOE and WDOH 1998).

Radiation Protection - Air Emissions. Washington Department of Health. Washington Administrative Code, WAC 246-247 (WAC 1994).

General Environmental Protection Program. U.S. Department of Energy. DOE 5400.1 (DOE 1988).

Radiation Protection of the Public and the Environment. U.S. Department of Energy. DOE 5400.5 (DOE 1990).

General Design Criteria. U.S. Department of Energy. DOE 6430.1A (DOE 1987).

Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance. U.S. Department of Energy. DOE/EH-0173T (DOE 1991).

Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities. American National Standards Institute ANSI N13.1-1969 (ANSI 1969).

Specifications and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents. American National Standards Institute ANSI N42.18 1980b (ANSI 1980).

The following additional requirements for sampling/monitoring at the 331 Facility are prescribed in PNNL operational and programmatic documents:

Standards-Based Management System A-Manual PNL-MA-8, Waste Management and Environmental Compliance. Pacific Northwest National Laboratory, Richland, Washington. (PNNL 1997)

Standards-Based Management System Subject Area Airborne Emissions. Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Airborne Emissions)

Standards-Based Management System Subject Area Creating or Modifying Engineering Calculations, Drawings, and Specifications. Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Creating or Modifying Engineering Calculations, Drawings, and Specifications)

Standards-Based Management System Subject Area Managing Liquid Effluents. Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Managing Liquid Effluents)

Standards-Based Management System Subject Area Managing Nonradioactive Chemical Waste. Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Managing Nonradioactive Chemical Waste)

Standards-Based Management System Subject Area Working With Chemicals. Pacific Northwest National Laboratory, Richland, Washington. (SBMS, Working With Chemicals)

3.2 Criteria for Radiological Air Emission Sampling and Monitoring

Airborne radionuclide emission points at PNNL are classified as either "major" or "minor." These two categories are defined as follows:

Major emission points are those where radionuclide emissions could cause an offsite emission dose (OED)^(a) of 0.1 mrem/yr, if emission controls were not applied. Major emission points are sampled according to requirements in Subpart H of EPA (1990).

^(a) The annual OED is the maximum committed effective dose equivalent that could be expected to be received by an offsite individual from facility airborne radionuclide emissions if the facility was operated without any HEPA filtration or other emission controls. The method for calculating the OED consists of identifying the radionuclide inventory potentially available for release, multiplying this by a fractional release value, and multiplying this product times an emission dose factor calculated by the EPA Clean Air Act compliance code CAP-88. Ballinger et al. (1995) provides additional discussion of this assessment method.

Minor emission points are those that potentially could release radionuclides, but not at the levels of a "major" point.

The 331 Building main stack is considered a "major" emission point according to the criteria above and continuous sampling for radiological air emissions is required. Emission points from 331-H and 331-G are considered "minor". The 331-C and 331-D Buildings do not have a potential to release radionuclides.

3.2.1 Sampling System Performance Criteria

Sampling at each major emission point shall be capable of detecting an annual radionuclide release quantity resulting in a total OED of 0.01 mrem/yr (DOE 1991).

All radionuclides anticipated to contribute greater than 10% of the potential to emit (PTE) from the sampled emission point shall be accounted for, either by direct analysis or by inference from an indicator measurement. The measurement for individual radionuclides shall be capable of detecting an annual radionuclide release quantity resulting in a total OED of 0.01 mrem/yr.

Biases in emission measurements, arising from the sample collection and analysis process, shall be minimized through the judicious application of design and operation practices according to American National Standards Institute (ANSI) (1969) and DOE (1991).

3.2.2 Sampling System Design Criteria

Samplers shall be located according to criteria in EPA (1971) Method 1 in Appendix A. Method 1 states that

Sampling or velocity measurements are to be performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame.

However, the method also states that,

If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and 0.5 diameters upstream from any flow disturbance.

Air emission samplers should be designed to maximize the sensitivity of the sample, considering the capacity of the collection media, radioactive decay, and sample-analysis costs. Representative samples shall be withdrawn on a continuous basis at the sampling site following the guidance in ANSI (1969), Appendix A, Section A3.2, which recommends a minimum of six extraction points for the 331 Facility main stack (EP-331-01-V). Furthermore, ANSI (1969) recommends that each withdrawal point within a cylindrical stack be centered in an annular area of size equal to the cross sectional area divided by the number of probes. Withdrawal points may be on a single traverse or spaced to obtain samples from the total cross section. Additional design criteria for particulate and gaseous radionuclides are specified by ANSI (1969) and DOE (1991).

3.2.3 Sampling System Operation

PNNL's Effluent Management Group maintains sampling system configuration drawings for all emission point radionuclide air sampling systems. This includes calculations of sampling system efficiencies particle sizes of 1 micron and 10 microns. A 1 micron particle size is assumed under normal operating conditions because most radionuclide air emissions are HEPA filtered.

Sampling-system operating criteria are based on regulations and guidance documents listed in Section 3.1.

Sampling shall be performed to quantify emissions over a calendar year. Sample-collection frequency shall be based on the need for unbiased samples while maximizing sensitivity and minimizing analytical costs. The period of sample collection, thus, should be as long as possible, considering the half-life of the radionuclide, the capacity of the collection media, and the need for timely return of sampling data.

Laboratory analysis of samples shall be according to procedures required by Appendix B, Method 114 "Test Methods for Measuring Radionuclide Emissions from Stationary Sources" in EPA (1990). Analyses should be conducted by radioanalytical laboratories according to prescribed statements of work. Work statements specify analytical performance requirements, including minimum detectable activity (MDA), turnaround time, reporting requirements, quality control (QC) requirements, and sample handling.

Sampling performance criteria in Section 3.2.1 specify an emission detection level of 0.01-mrem/yr OED. The analytical MDA required to meet this criterion depends on a combination of factors, including sample size, stack flow rate, collection period, radionuclide half-life, and radionuclide emission dose factor.

Historically, laboratory analysis of particulate emission samples from the 331 Complex emission points that were sampled consisted of total-activity (total alpha, total beta) measurements. Total-activity measurements were performed because:

- emissions were historically very low
- potentially significant constituents of the emission stream were known
- the gross-activity measurement was nondestructive; radionuclide-specific measurement could be performed on the sample if gross-activity measurements showed a potentially significant release quantity.

When gross-activity measurements were used for assessing offsite dose, dose factors for the most restrictive radionuclide potentially contributing 10% or more to the annual emission dose were applied.

All of the 331 Complex facility emission points were either considered "minor" or had no potential to emit radionuclides until 1997 when a scheduled move of additional research projects into the 331 Building increased the inventory such that the main emission point from 331 was upgraded to "major." As of 1998, airborne particulate samples for the 331 Building major emission point have been analyzed for several specific radionuclides in addition to the gross-activity measurements. These specific analyses included those radionuclides potentially contributing 10% of the PTE for the building.

Exhaust-stream flow rates at sampling locations shall be measured using EPA Method 2 (EPA 1971). Flow-rate measurements should be performed on a periodic basis for major emission points as well as following modifications to the exhaust system that could be expected to cause the average exhaust rate to differ by $\pm 10\%$ from the previously measured rate. The exhaust stream flow rate from minor emission points should be measured annually.

Air-emission samplers should be designed to maximize the sensitivity of the sample, considering the capacity of the collection media, radioactive decay, and sample-analysis costs.

Isokinetic sampling is required for major emission points where particulate emissions are expected.^(a)

Under most operating conditions, isokinetic sampling can be adequately accomplished by operating the sampler so that 1) sample probes are aligned axially with the stack and point into the direction of stack flow, and 2) sample nozzle inlet velocity is maintained within a factor of two of the mean stack-exhaust velocity at the sample location.^(b)

(a) Emissions from the 331 main stack are filtered using HEPA filters before discharge. Unless failure of a HEPA filter system occurs (an unlikely event), particle emissions are expected to be relatively small. Based on criteria in ANSI (1969), isokinetic sampling for systems emitting particles less than 5- μm aerodynamic diameter is not necessary. DOE (1991) recommends isokinetic sampling when particles are greater than 0.5- μm aerodynamic median diameter.

(b) From Table C1 in ANSI (1969), a sampler operating at an inlet velocity of within a factor of two of the stack velocity will have a particle interception bias of 14% for a 4- μm aerodynamic equivalent diameter (AED)

Footnote continued on next page

At the "major" emission points, the sampler is operated continuously, except during planned sampler maintenance or testing outages. When continuous sampling is required, the loss of sampling capability is limited to 24 h/month. If this limit is exceeded, special interim sampling is provided, or pertinent facility operations are shut down.

3.3 Historical Monitoring/Sampling Data for Effluent Streams

The 331 Facility was built in 1970 for biological and botanical research. Associated buildings (331A to 331J) were constructed during the 1970s for various support functions. Some of the effluent streams from the 331 and support buildings have been sampled and monitored over the history of operations. Information from historical sampling and monitoring is provided in this section to aid in providing a basis for future monitoring needs. A description of historic sampling and monitoring data under normal operating conditions for air and liquid effluent streams is given in Section 3.5.1. Estimates of the types of releases and release pathways experienced during facility operations under upset conditions are given in Section 3.5.2.

3.3.1 Normal Conditions

Some of the air and liquid-effluent streams have been sampled and monitored since the 331 Complex Facilities started operations. The types and locations of sampling and monitoring and analytical methods under normal operations are described in this section. Discussion is generally limited to the past 7 years (1991 through 1997) because this period is the most relevant to future operations and monitoring needs.

3.3.1.1 Radionuclide Air Emission Sampling

Effluent air from the 331 Building main exhaust and from 331-H has been sampled and monitored downstream of the final HEPA filters for radioactive particles. Sampling for particulate gross alpha and beta has been provided by a record sampler for the past 7 years. During this time, both the 331 main stack and the 331-H stack were considered minor emission points for radioactive air emission sampling.^a Sampling of the 331-H stack was discontinued in 1997 because the building radioactive inventory consisted solely of sealed sources. Recently, in 1998, the radionuclide inventory in the 331 Building was increased due to the addition of research projects moved from other facilities. The increased inventory resulted in an upgrade of the main stack to "major" status, and continuous sampling was initiated in April of 1997. Estimated emissions calculated from the sampling data from 1991 to 1997 are shown in Table 3.1.

Table 3.1 Estimated Annual Emissions from 331 and 331-H

Year	331		331-H	
	Gross Alpha, Ci	Gross Beta, Ci	Gross Alpha, Ci	Gross Beta, Ci
1991	3.9E-7	4.2E-5	2.6E-8	1.6E-6
1992	ND	6.6E-6	ND	6.3E-7
1993	2.0E-7	2.1E-6	3.4E-8	2.9E-7
1994	1.3E-7	3.8E-7	9.3E-9	1.0E-8
1995	4.1E-8	3.5E-7	9.3E-9	3.6E-8
1996	2.0E-7	2.7E-6	ND	ND
1997	2.5E-7	2.8E-6	Not Measured	Not Measured
ND = Not Detectable				
Not Measured – Measurements from 331-H were no longer taken in 1997 because the radionuclide inventory consisted of sealed sources only.				

particulate emission.

^(a) The 331-A stack was also sampled prior to 1997, but was decommissioned and taken down in 1997.

3.3.1.2 Liquid Effluent Sampling and Monitoring

Liquid waste streams in the 331 Complex facilities have been served by three systems as described in Section 2.3.2. Table 3.2 summarizes the type of historical monitoring/sampling each liquid waste system has had. As noted in the table, historically, 300 Area sanitary liquid waste was sampled at the SNS system just before the waste entered the SNS septic tanks. Before 1997, sanitary wastes were discharged to a 300 Area septic tank/trench system. In 1997, the 300 Area SNS was connected to the City of Richland POTW. The *Westinghouse Hanford Company Effluent Report for 300, 400, and 1100 Area Operations* (McCarthy 1990) briefly describes the sampling and analysis program before being connected to the City of Richland POTW. Because this sampling program is not specific to the 331 Complex facilities, its historical data are not reported here.

Table 3.2 Summary of Historical Liquid Monitoring/Sampling

System	Comments
SNS	No sampling or monitoring at 331 Facilities. Sampled as composite with other 300 Area SNS before 1997 and sampled as required by contract with City of Richland POTW after 1997 hook-up. Currently required sampling is performed by the 300 Area infra-structure contractor.
PS	Sampling of 331 PS conducted as part of PNNL's 1994 and 1995 sampling campaign to characterize liquid wastes for TEDF.
Aquaculture	Sampled as required by NPDES Outfall from 1976 to the present.

Historically, the 300 Area PS was discharged to trenches. Samples of the composite liquid waste from all the 300 Area PS lines were taken before the liquid was discharged to the 300 Area process trenches (McCarthy 1990). These sampling data are not specific to the 331 Complex facilities and thus are not included in this report. In December 1994, a treatment facility, the 300 Area TEDF, was brought into operation to replace the trenches. To support TEDF design, PS samples were taken from various locations in the 300 Area in 1989 (WHC 1989). However, no samples were taken specific to the 331 Complex facilities.

PNNL conducted a separate facility-specific sampling campaign in 1994 and 1995 to characterize the waste streams from the primary PNNL research and development (R&D) facilities. Sampling and analysis for radioactive and non-radioactive constituents occurred at the 331 PS manhole as a result of the campaign. The data are summarized in Table 3.3. Additional details can be found in Thompson et al. (1997). The data show that liquid effluents from the 331 PS have a variety of different constituents. Most of these are in small (parts per billion or $\mu\text{g/L}$) concentrations. However, some samples contained constituents that exceeded the TEDF waste-acceptance criteria. In these cases it was found that samples taken simultaneously at the end-of-pipe (where the 300 Area PS stream converges and is pumped up to TEDF) did not exceed the waste acceptance criteria.

Table 3.3 Constituents Detected in Building 331 Samples

		Concentration (µg/L) ^(a)		
Constituent	Frequency ^(b)	Range	Average	Standard Deviation ^(c)
General Chemical Parameters				

^(a) Conductivity units are $\mu\text{mhos/cm}$ and radiological parameters are pCi/L .

^(b) Number of samples with detectable concentrations/total number of samples analyzed.

^(c) Two times the standard error of the mean for radiological parameters.

Constituent	Frequency ^(b)	Concentration (µg/L) ^(a)		
		Range	Average	Standard Deviation ^(c)
Alkalinity	45/45	40,000 – 130,000	68,000	20,000
Chemical Oxygen Demand	32/38	6000 – 140,000	22,000	24,000
Conductivity	34/34	72 – 920	250	150
pH	34/34	5.1 – 8.8	7.6	0.85
Total carbon	38/38	14,000 – 76,000	22,000	10,000
Total dissolved solids	43/43	90,000 – 480,000	140,000	62,000
Total organic carbon	44/44	2,000 – 61,000	6500	9000
<i>Ammonia and Anions</i>				
Ammonia	34/45	30 – 1000	140	230
Bromide	2/42	140 – 200	170	-
Chloride	43/43	3600 – 170,000	11,000	24,000
Cyanide	33/43	1 – 70	17	20
Fluoride	43/43	300 – 1100	640	150
Nitrate	43/43	300 – 33,000	6100	7900
Nitrite	2/35	110 – 130	120	-
Phosphate	31/43	210 – 82,000	7100	15,000
Sulfate	43/43	10,000 – 48,000	19,000	5800
Sulfides	12/38	200 – 400	240	64
<i>Metals</i>				
Aluminum	43/44	22 – 630	150	160
Arsenic	5/44	2 – 3	2.4	0.5
Barium	44/44	17 – 48	29	6
Beryllium	1/44	-	0.19	-
Cadmium	2/44	-	3.4	-
Calcium	44/44	16,000 – 43,000	24,000	6300
Chromium	6/44	4.3 – 22	13	8
Copper	44/44	9.5 – 930	51	140
Iron	42/44	18 – 460	85	78
Lead	36/44	0.6 – 17	2.5	2.8
Magnesium	44/44	3900 – 18,000	5500	2200
Manganese	35/44	1 – 16	3.4	3.3
Mercury	11/44	0.055 – 0.17	0.096	0.036
Nickel	2/44	16 – 17	17	-
Potassium	43/44	940 – 12,000	3400	2500
Selenium	5/44	0.95 – 2	1.5	0.51
Silicon	2/2	3000 – 3200	3100	-
Silver	2/44	3.6 – 7.1	5.4	-
Sodium	44/44	3300 – 110,000	13,000	17,000
Strontium	3/3	93 – 110	100	9
Thallium	4/44	0.58 – 1.1	0.83	0.21
Tin	5/44	24 – 110	71	31
Vanadium	6/44	2 – 7.8	4.3	2.6
Zinc	44/44	22 – 230	67	39

		Concentration (µg/L) ^(a)		
Constituent	Frequency ^(b)	Range	Average	Standard Deviation ^(c)
Volatile Organic Compounds				
1,1,1-Trichloroethane	1/66	-	2.	-
2-Butanone	3/66	51 – 170	100	61
Acetone	15/66	5.6 – 1800	140	460
Acetonitrile	1/26	-	430	-
Bromodichloromethane	16/34	0.5 – 9.8	2.3	2.3
Bromoform	1/34	-	26	-
Chlorobenzene	1/26	-	0.39	-
Chloroform	66/66	3.1 – 33	11	6.5
Dibromochloromethane	6/34	0.7 – 11	2.7	4.1
Ethanol	5/66	8.3 – 47	21	15
Hexone	4/66	1.9 – 19	11	9.2
Isopropyl alcohol	1/66	-	19	-
Methylene chloride	43/66	0.4 – 4.8	1.2	0.9
Tetrahydrofuran	2/66	0.52 – 3	1.8	-
Toluene	4/66	0.22 – 0.86	0.53	0.26
Trichloroethene	3/66	0.51 – 0.91	0.	0.23
Xylenes (total)	3/66	1.4 – 2.4	1.8	0.5
Semivolatile Organic Compounds (Acids/Bases/Neutrals)				
Benzyl alcohol	3/15	4.1 – 34	22	16
Bis(2-ethylhexyl) phthalate	8/46	1 – 6.4	3.7	2.3
Decane	1/32	-	37	-
Di-n-butylphthalate	4/14	2 – 3.6	2.5	0.8
Kerosene	1/14	-	9.5	-
Phenol	4/46	1 – 4.9	2.5	1.8
Semivolatile Organic Compounds (Pesticides)				
4,4'-DDE	3/40	0.0017 – 0.72	0.24	0.41
Aldrin	1/40	-	0.011	-
Alpha – BHC	3/40	0.0036 – 0.0073	0.0057	0.0019
Beta – BHC	4/40	0.0099 – 0.026	0.017	0.0083
Delta – BHC	10/40	0.0017 – 0.033	0.011	0.0088
Dieldrin	1/40	-	0.0032	-
Endosulfan I	6/40	0.0018 – 0.005	0.0032	0.001
Endrin	2/40	0.0025 – 0.0066	0.0046	-
Endrin aldehyde	1/40	-	0.012	-
Gamma – BHC (Lindane)	5/40	0.0023 – 0.0038	0.0029	0.0007
Methoxychlor	1/40	-	0.019	-
Radiological Parameters				
Gross Alpha	19/47	0.91 – 8.3	3.0	0.47
Gross beta	27/47	2.1 – 15	5.2	0.58
Tritium	½	-	330	-

The aquaculture system outfall has been sampled and monitored as required by the NPDES permit since 1976. A review of Outfall 013A historical monitoring data is summarized in Table 3.4 for the last 7 years of operation (1991 to 1997). These data were obtained from outfall samples collected in accordance with the NPDES permit and reported in monthly DMRs as required by the permit. As shown in the table, monitoring measurements have been within permit limits.

Table 3.4 Data from Monitoring 331 Aquaculture System

Year	Monthly Flow Range, MGD		pH	Total Suspended Solids		Settleable Solids
	Average	Maximum	Range	Range (mg/L)	Average (lbs/day)	Range (mL/L)
Limits	1.08	1.73	6 – 9	15	75	0.2
1991	0.77 - 1.12	0.83 - 1.22	7.7 - 8.3	0.5 - 4.4	3.3 - 34.5	< 0.1
1992	0.66 - 1.06	0.74 - 1.13	7.9 - 8.2	0.5 - 1.6	2.8 - 12.4	< 0.1
1993	0.73 - 1.10	0.80 - 1.38	7.7 - 8.3	< 0.5 - 4	< 4.6 - 31	< 0.1
1994	0.48 – 1.07	0.65 – 1.59	7.2 – 8.3	< 4.0	< 16 - < 25	< 0.1
1995	0.49 – 0.84	0.61 – 0.90	7.1 – 8.1	< 1.1 - < 4.0	< 4.5 - < 28	< 0.1
1996	0.38 – 0.97	0.44 – 1.09	6.5 – 8.3	< 1.0 – 7.0	< 6 - 57	< 0.1
1997	0.39 - 0.72	0.54 - 0.85	7.7 - 8.4	< 1.1 - 5.1	< 5 - 27	< 0.1

3.3.2 Upset Conditions

The nature of upset conditions potentially affecting the environment around or effluent sampling systems in the 331 Complex facilities since 1991 are shown in Table 3.5. This table summarizes the type of events categorized as off-normal or unusual occurrences. The types of events shown in the table could be expected to occur during future operations and are considered in effluent monitoring planning.

The greatest number of occurrences listed were from radioactive contamination found outside designated areas or on personnel. Some of this contamination was discovered during facility modifications and was present from past operations. When known, facility holdup is included in the annual inventory-based assessment (see Appendix A) or in applicable NOCs so that it is considered in determining facility monitoring requirements.

Table 3.5 Off-Normal and Unusual Occurrences in the 331 Complex

Type of Event	Number of Occurrences
Radioactive contamination found outside radiation areas or on personnel	18
Spills or releases of hazardous chemicals (mercury, freon, acetonitrile)	6
Procedural Violations (failure to follow safety or radiation procedures)	5
Power Outages, Loss of Ventilation, Loss of exhaust sampling system	3
Environmental Penalty (Failure to Designate Waste)	1

Spills or releases of hazardous chemicals have also occurred in and outside of the 331 facilities. Special sampling may be performed in these events to aid in quantifying or characterizing the release or to determine whether there are any continued effects.

A number of procedural violations have occurred, primarily in following safety or radiation-control procedures. These types of events illustrate the need for continued vigilance with respect to effluent-management procedures. PNNL's Effluent Management Group has a quality assurance plan (see Section 5.0) that describes training, procedures, quality improvement, and assessments to minimize the potential for unwelcome consequences from procedural violations and to evaluate effects.

Disruptions to the facility primary power, exhaust flow, or air emission sampling systems may interrupt air-emission sampling periods. Because the 331 Building is required to be continuously sampled, interruptions in sampling are minimized by maintaining critical backup components and providing frequent inspections of the sampling system. Monitoring the flow from the aquaculture discharge is also continuous, and malfunctions of the flow meter have occurred. Spare parts are maintained to minimize the impact on data. Also, data are manually read from flume markings to estimate flow when the flow

meter fails. The large and relatively constant discharge reduces the error potential in the manual readings.

Sampling for air chemical emissions or liquid effluents is periodic, and loss of power or sampling equipment malfunctions are not considered critical. The sampling period can be adjusted or a discrepancy report completed to identify and correct for the effect on the air-chemical or liquid-effluent measurements taken. Section 3.8 discusses alternative sampling methods.

3.4 Sampling System Description

Of the 331 Complex emission points, airborne radionuclide emission sampling is performed at the 331 main facility stack (EP-331-01-V) only. Although the 331-G and 331-H facilities also have radionuclide inventories, estimates of annual emissions from these facilities are based on engineering calculations because actual emissions are too small to quantify through periodic sampling. Thus, the following discussion will focus on the sampling system at the 331 facility main stack.

The building main stack, located on the roof of the 331 Facility, discharges ventilation exhaust from 331 laboratories at an exhaust rate of about 64,000 cfm. Because the stack flow is primarily building ventilation air, stack-gas specific gravity, humidity, and temperature are typical of the ventilation exhaust from an occupied building.

To support development of a stack-emission measurement program for the 331 Facility, staff must know the types and quantities of radionuclides potentially present in the ventilation exhaust. An index of emission potential is used by PNNL so that the relative significance of different radionuclides and different emission points can be compared. The index, expressed in terms of a projected potential dose equivalent to a maximum offsite receptor, is based on emission-assessment methods in EPA (1971). It is assumed that no engineered emission controls (e.g., HEPA filters) are provided in the ventilation system and that without such controls, the potential for radionuclide emissions is related to the quantity and physical form of radioactive material in the facility. This assessment method is described in Ballinger et al. (1995).

Radionuclides of primary importance in the 331 Facility from an emission-sampling standpoint are determined on an annual basis, using the above methods. Radionuclides potentially contributing $\geq 10\%$ of the PTE are specifically analyzed from composited filters every 6 months. Radionuclide inventory varies from year to year. Therefore, the nuclides of interest, those contributing $\geq 10\%$ of the PTE, are updated annually to account for these variations.

An isokinetic sampling system (ESP-331-01-D) that is compliant with NESHAP requirements in EPA (1990) is used to sample continuously for particulate radionuclide emissions. A schematic diagram is provided in Figure 3.1. Detailed descriptions are provided below. The radionuclide sampling system was installed on the main building stack in 1994. The system, which began operating in 1995, complies with the sampler design criteria in Section 3.2.2.

The airborne radionuclide sampling system incorporates a six-nozzle, isokinetic sampling probe assembly (Figure 3.2) positioned approximately 62 ft above ground in the main stack (Figure 3.3). The probes are eight equivalent diameters downstream of the flex connection at the stack entrance and slightly over two equivalent diameters upstream of the bend leading to the stack exit. Probe nozzles are located at the centers of equal annular areas according to requirements in ANSI (1969).

Near-isokinetic sampling conditions are maintained by adjusting the flow rate through the collection system so that the average airflow velocity through the sampler inlet nozzles corresponds to the average stack velocity measured at the nozzle locations. Stack emission samples are withdrawn from the stack and through the system by means of the building vacuum air sampling system. Withdrawal rates are controlled by valves located downstream of the sampling system. Flows are measured by a rotameter upstream of the control valves. Stack velocities are measured on a quarterly frequency using Method 2 in EPA (1990).

The sample transport line extends from the probe assembly to just outside the stack on the roof where the sample cabinet is located. The transport lines are of stainless steel tubing and are heat traced, thermally insulated, and electrically grounded.

Transport efficiency of the collection systems has been calculated. The transport efficiency of the sampling system is greater than 95% for an assumed 1-micron activity median aerodynamic diameters (AMAD) aerosol at nominal sampler and stack flow rates.^(a)

Airborne particles are collected on a 47-mm-diameter membrane filter (Gelman Versapor 3000TN). The V-3000TN has an estimated retention efficiency for 0.3-micron particles of greater than 91% at face velocities of 180 fpm.

980800087.15

Figure 3.1 Schematic of 331 Main Stack Sampling System

^(a) Loss calculations were performed using DEPO Version 4.0 (Riehl et al. 1996). A 1-micron AMAD polydisperse aerosol was assumed for the calculations based on the assumption that building operations and controls (HEPA filters) are "normal."

Sampling Manifold

980800087.8

Figure 3.2 Sampling Probe for 331 Main Stack

Figure 3.3 331 Main Stack Sampling System Configuration

The sample collection filter is normally replaced every 2 weeks, but may be replaced more frequently depending on filter loading. The sample filter is stored for a minimum of 5 days after being removed from the sampler to permit decay of radon and thoron daughter radionuclides. The filter is then analyzed for gross alpha and gross beta radioactivity.

Each sample is screened individually for gross-alpha and gross-beta activity. Then the samples are collected over a 6-month period (semi-annual), combined, and analyzed for specific radionuclides as determined by the annual inventory assessment. The Radioanalytical Application Team (RAT) staff in the 325 Facility analyze samples using methods described in Chapter 4.0. Sample analysis results are evaluated as described in Section 3.6.

3.5 Sampling System Performance

This section describes the performance capability of the stack sampling system in terms of the offsite dose potentially resulting from a release. The determination of minimum sampler capability is based on a series of assumptions of worst-case-exposure scenarios, resulting in calculations of upper bound doses. Thus, the methods used here to evaluate system capability are not appropriate for assessing actual

3.5.1 Stack Radionuclide Sampling System Performance

Performance criteria for sampling are provided in Section 3.2. Two of the criteria concern measurement sensitivity, and the third concerns measurement bias. The criterion for bias is based on conformance of the system to design and operational guidance in ANSI (1969) and DOE (1991). System-description information in Section 3.2.4 is consistent with the design and operational guidance; thus, the bias criterion is met.

Sensitivity criteria (Section 3.2) for sampling are stated in terms of detectable offsite dose. According to the criteria, compliance sampling shall include measurement of radionuclides that could contribute greater than 10% of the PTE for the release point. Per performance criteria in Section 3.2.1, radionuclides should be detectable at emission levels resulting in an annual, committed effective dose equivalent of 0.01 mrem/yr. For example, for the 331 Facility, radionuclides required to be measured at the compliance stack (EP-331-01-V) according to the 1998 assessment are ^{238}Pu , and ^{243}Am . Total alpha activity and total beta activity are also measured at all stacks to screen for the presence of particulate radionuclides.

Annual release quantities associated with an effective dose equivalent of 0.01 mrem/yr were calculated from dose factors obtained using the EPA compliance code CAP-88 (Ballinger et al. 1995). These values are shown in Table 3.6.

The sensitivity of particulate radionuclide sampling is proportional to the collection efficiency of the sampler, the fraction of the emission quantity collected by the sampler (i.e. sampler efficiency), and the level at which the radionuclide can be detected in the collected sample. Under isokinetic sampling conditions, the 331 Facility particulate sampler will intercept approximately 1/32,000 of the activity emitted via the stack (i.e., ratio of sampling rate to stack flow rate). Loss of particulates in the sampling system due to deposition, plateout, and filtering efficiency are estimated to be less than 5% for a 1-micron AMAD particulate aerosol^(a). Using the contractual minimum detection level specified in the analytical laboratory statement of work, the annual minimum detectable release for specific radionuclides are as shown in Table 3.1.

Table 3.6 Detection of Significant Radionuclides in 331 Stack Emissions

Radionuclide	Analytical Limit (pCi/sample) ⁽¹⁾	Detectable Annual Release (Ci)	Emission Resulting in 0.01 mrem/yr (Ci) ⁽⁴⁾
Beta Activity	38 ⁽²⁾	2.4E-5	2.0E-3 (as ^{137}Cs)
Alpha Activity	1.0 ⁽²⁾	6.4E-7	5.6E-5 (as ^{238}Pu)
^{238}Pu	1 ⁽³⁾	4.2E-8	5.6E-5
$^{239/240}\text{Pu}$	1 ⁽³⁾	4.2E-8	5.0E-5
⁽¹⁾ From analytical lab statement of work			
⁽²⁾ Includes correction for 15% reduction of the alpha and beta emissions originating from the sample that are absorbed by the sample media and surface dirt on the filter (Higby 1984).			
⁽³⁾ Value for a 6-month composited group.			
⁽⁴⁾ Based on dose per release factors calculated using CAP-88 (Ballinger et al. 1995).			

From table 3.6, it is apparent that the capability of the 331 Facility stack sampling system exceeds the minimum criteria for detection of radionuclides in emissions.

3.5.2 Liquid Effluent Sampling and Monitoring

The only 331 Complex liquid effluent system with required routine liquid effluent sampling and monitoring is the aquaculture system. This system serves the 331 aquatics research laboratory that draws on both

^(a) Calculated using DEPO 4.0 (Riehl et al. 1996) assuming a particulate aerosol with an AMAD of 1.0 microns.

river and well water sources for supplying water for fish-rearing activities. Wastewater from these operations is discharged to an outfall structure located East of the 331 Building within the fence-line of the 300 Area. This discharge is known as Outfall 013A of the Hanford Site NPDES permit (WA-000374-3). The permit has been in place since 1976. The current permit, re-issued in 1981 and continued in effect per 40 CFR 122.6, identifies effluent limitations and monitoring requirements for this discharge. These effluent requirements are summarized in Table 3.7.

Table 3.7 Effluent Requirements for Aquaculture Outfall

Effluent Characteristic	Discharge Limitations		Monitoring Requirements	
	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
pH	--	6 – 9	Monthly	Grab
Flow	4,098 m ³ /day 1.08 MGD	6,540 m ³ /day 1.73 MGD	Daily	--
Settleable Solids	0.1 mL/L	0.2 mL/L	Monthly	Grab
Suspended Solids	34 kg/day 75 lbs/day	45 kg/day 99 lbs/day 15 mg/L	Monthly	24-h composite

Other permit criteria are as follows:

- There shall be no discharge of floating solids or visible foam in other than trace amounts.
- Effluent limitations are net values allowable above that of the intake water.
- There shall be no discharge of pollutants other than those normally found in fish hatchery discharges. Chemicals used for experimental purposes shall not be discharged.
- Samples taken in compliance with the monitoring requirements specified above shall be taken before discharge to the Columbia River.

To meet the above criteria, PNNL EM performs sampling according to procedures that incorporate the sampling criteria. Sampling is performed at a concrete monitoring station and flume enclosure located approximately 11 feet upstream of the outfall headwall^a. The monitoring station consists of a 10-inch flume insert, a flow meter, and a refrigerated sampler. This sampler may be operated in composite, time-proportional, and flow-proportional sample-collection mode. Figure 2.11 is a diagram of the aquaculture system. Section 3.5 provides a summary of historic data from aquaculture outfall sampling and monitoring. Discharge monitoring reports (DMRs) are prepared monthly to meet reporting requirements.

Several 331 Complex facilities (331, 331-D, 331-G, 331-H) have laboratories that are serviced by the PS. A liquid-effluent sampling and monitoring system is installed in the PS at a location downstream of these facilities. The system has been used (see Section 3.5) and continues to be used to characterize facility effluents, when needed, and to investigate potential discharges of concern. The primary criteria for this sampling system were developed by the 300 Area TEDF operating contractor in support of TEDF operations and are provided as follows:

- Sampling is required to characterize waste streams discharged to TEDF if process knowledge is inadequate; process knowledge may be used if the facility has only repetitive, well-characterized operations that are consistent over time.
- Characterization sampling must ensure that a valid sample is obtained.
- The number of characterization samples collected must be sufficient to clearly demonstrate that the stream has been adequately characterized.

^(a) The area between the headwall and the river consists of riprap overgrown with plants and vegetation, sloping down-gradient for approximately 58 meters before final discharge to the Columbia River.

- Characterization samples shall be analyzed for all classes of constituents not known to be absent from the waste stream.
- Characterization samples shall be collected and handled as specified in a table provided by the TEDF operating contractor. This table lists hold times, minimum sample sizes, sample types (grab/composite), preservatives, and sample containers based on regulatory requirements.

The PS liquid-effluent sampling system is located outside of the 331 Building and is currently being repositioned after facility piping modifications. The system has the capability to measure pH, conductivity, and flow as well as taking grab or flow-composite samples. The refrigerated sampler controls temperature of samples taken to ensure preservation requirements are met. Figure 3.4 is a schematic of the system. PNNL's Effluent Management Group has sampling procedures in place and a contract with an analytical laboratory to ensure that sampling requirements are met.

Figure 3.4. Schematic of 331 Complex PS Sampling and Monitoring System

3.6 Handling of Sampling and Monitoring Data

Routine compliance measurements are taken from the 331 main stack for radiological air emissions and from the aquaculture system for liquid-effluent discharges. In addition, periodic sampling or monitoring data on air chemical emissions from the 331 Building or on 331 Complex PS liquid discharges may be collected to verify, characterize, or investigate effluents. This sampling is performed by PNNL EM. Sampling data are handled according to the following general requirements:

- Chain of Custody (COC) forms are generated for each sample to track the sample from collection through disposal. COCs contain the place, date, and time of sampling; who performed the sampling and measurements; the signature, name, date, and time of transfers; and any applicable special instructions on storage and preservation or reference to a statement of work (SOW) for specific instructions. For field measurements where the measurement is taken immediately (within 15 minutes), and the sample is not transferred, the COC information can be documented in a log book.
- Data are validated to detect potential quality problems in analytical data. Data are reviewed for 1) results that indicate detectable sample activity or chemical concentration, 2) results above any pre-defined action level, and 3) results that are unexpected compared to historical measurements.
- Discrepancies, anomalies, unusual data, or data above action levels are investigated and the resolutions documented using a discrepancy report.
- Manipulation of measurement data into a format that will be reported to DOE or regulatory agencies or that will be used as a basis for regulatory decisions is documented to ensure traceability. Technical reviews are performed on calculations involving sampling data to ensure accuracy.

- Sampling data records are maintained according to regulatory requirements that are specified in the Effluent Management Project Records Inventory and Disposition Schedule (RIDS).

These general requirements and the management requirement specific to data obtained from each activity performed by PNNL EM (e.g., radiological air-emission sampling, air chemical-emission sampling, liquid-effluent compliance sampling) are documented in an internal group plan for managing data. The following sections give specifics on data management for routine compliance sampling.

3.6.1 Radiological Air-Emission Data

Results obtained from the record sampling program are used to evaluate existing facility emission levels and to calculate annual emission quantities for compliance determination and reporting purposes.

Particulate samples are collected as described in Section 3.2. Analysis of samples by a laboratory is described in Chapter 4. Data are evaluated using documented and approved procedures. Data evaluation procedures are based on guidance in DOE (1991), *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* and EPA (1980), *Upgrading Environmental Radiation Data*.

Airborne-emission sampling data are reviewed for anomalies and trends. Provisional release estimates are updated throughout the sampling year (calendar year) as data are received. At the completion of the calendar year, data are reviewed, and the provisional release estimate is refined, as necessary, to account for anomalies or missing data as well as a significantly skewed data set. Anomalous data are investigated, and conclusions of the investigation are documented.

Final release quantities include corrections for isokinetic sampling efficiency, sample transport losses, sample self-absorption, decay, counting efficiency, background, and collection media efficiency.

3.6.2 Aquaculture Outfall Data

Results obtained from monitoring the 331 aquaculture system are used to meet NPDES permit sampling and monitoring requirements. Samples are collected as described in Section 3.4. Analysis of samples by a laboratory is described in Chapter 4. Data are evaluated using documented and approved procedures.

Aquaculture discharge sampling and monitoring data are reviewed for anomalies and trends on a monthly basis during preparation of the DMRs. Anomalous data are investigated, and conclusions of the investigation are documented. Notifications and repeat sampling are performed as required by the permit.

3.7 Calibration and Maintenance of Equipment

Sampling and monitoring equipment, including rotameters, are maintained and calibrated according to schedules determined when the equipment is installed or purchased. Stack flow rates are measured using a standard-type pitot tube that is recognized by EPA as a primary calibration standard. The aquaculture outfall flow meter is calibrated as recommended by the manufacturer. Equipment used to measure pH is user-calibrated before each use. Radiation-monitoring equipment is calibrated annually by the Radiation Instrumentation Services of PNNL. This group has responsibility for calibrating all portable radiation-protection instrumentation at Hanford.

Continuous, "major", sampling systems are inspected each workday by the PNNL Radiation Protection Section for proper flow-rate setting and system operation. "Minor" sampling systems are inspected weekly when during sampling periods. Liquid effluent sampling systems are inspected quarterly.

Calibration and preventative maintenance of installed facility effluent sampling and monitoring equipment are tracked by PNNL Maintenance Services. PNNL EM supports calibration and maintenance by helping develop calibration and maintenance procedures, obtaining vendor information on recommended

calibration and maintenance or on equipment functions, working with building managers to identify needed repairs, and performing inspections of sampling systems when needed to ensure proper functioning. The following PNNL SBMS (SBMS, Service Request Process and Calibration) provides requirements and guidance pertinent to Calibrations and Maintenance.

3.8 Alternative Sampling Methods

All sampling and monitoring system components have replacement units available, so down time is usually limited to a few hours, at most.

Alternative methods exist for assessing impacts of facility emissions. Workplace air-monitoring systems provide evidence of the presence or absence of radionuclides in room air. Contamination surveys, routinely performed throughout the facilities for radiological work areas, provide additional evidence of contamination spreads. Air-emission control systems are routinely checked for leaks. Differential pressure gauges installed across each filter bank provide evidence of filter plugging or breakthrough.

Alternative sampling methods for liquid effluent sampling for the 331 Complex facilities are not needed because sampling is periodic. Compliance sampling of the aquaculture outfall is performed monthly, and sampling can be rescheduled if the sampling system malfunctions. Spare parts and portable samplers are also available when needed.

An extensive environmental surveillance program is operated for the Hanford Site by PNNL. This program is described in detail in the Hanford Site Environmental Monitoring Plan (DOE 1997). The program performs ambient air sampling around the 300 Area perimeter as well as along the Hanford Site boundary and in adjacent communities. In addition to ambient air sampling, the environmental surveillance program samples groundwater, river water, drinking water, foodstuffs, soil, native vegetation, and aquatic and terrestrial animals. Annual reports issued by the Hanford Environmental Surveillance Program document the results of these samples.

3.9 References

ANSI 1969. *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*, ANSI N13.1-1969. American National Standards Institute.

ANSI 1980. *Specifications and Performance of Onsite Instrumentation for Continuously Monitoring Radioactivity in Effluents*, ANSI N42.18 1980b. American National Standards Institute

Ballinger, M. Y., S. J. Jette, and M. J. Sula. 1995. *Assessment of Unabated Facility Emission Potentials for Evaluating Airborne Radionuclide Monitoring Requirements at Pacific Northwest National Laboratory - 1995*. PNL-10855, Pacific Northwest Laboratory, Richland, Washington.

DOE 1987. *General Design Criteria*, DOE 6430.1A, U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.

DOE 1988. *General Environmental Protection Program*, DOE 5400.1, U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.

DOE 1990. *Radiation Protection of the Public and the Environment*, DOE 5400.5, U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C.

DOE 1991. *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*, DOE/EH-0173T. U.S. Department of Energy. Washington D.C.

DOE 1997. *Environmental Monitoring Plan*, DOE/RL-91-50, Rev 2, United States Department of Energy, Richland Operations Office, Richland, Washington.

EPA 1971. *Regulations on Standards of Performance for New Stationary Sources, Appendix A: Reference Methods*. 40 CFR 60. Environmental Protection Agency, U.S. Code of Federal Regulations.

EPA 1980. *Upgrading Environmental Radiation Data*. EPA 520/1-80-012. U.S. Environmental Protection Agency. Washington D.C.

EPA 1981. *National Pollutant Discharge Elimination System Permit-NPDES WA-000374-3*. U.S. Environmental Protection Agency. Washington D.C.

EPA 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition. U.S. Environmental Protection Agency. Washington, D.C.

EPA 1990. *National Emission Standards for Hazardous Air Pollutants*. 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations. 1990.

EPA 1993. *National Pollutant Discharge Elimination System Permit Regulations*. 40 CFR 122.6. U.S. Environmental Protection Agency, U.S. Code of Federal Regulations.

Higby, D. P. 1984. *Effects of Particle Size and Velocity on Burial Depth of Airborne Particles in Glass Fiber Filters*, PNL-5278, Pacific Northwest Laboratory, Richland, Washington.

McCarthy, M. J. 1990. *Westinghouse Hanford Company Effluent Report for 300, 400, and 1100 Area Operations for Calendar Year 1989*, WHC-EP-0267-1, Westinghouse Hanford Company, Richland, Washington.

Riehl, J., V. R. Dileep, N. K. Anand, A. R. McFarland. 1996. *Deposition 4.0 An Illustrated Users Guide*, Texas A&M University, College Station, Texas.

SBMS, Airborne Emissions. 1998. *Airborne Emissions*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/0g/0g00t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Calibration. 1998. *Calibration*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/79/7900t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Creating or Modifying Engineering Calculations, Drawings, and Specifications. 1997. *Creating or Modifying Engineering Calculations, Drawings, and Specifications*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/91/9100t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Managing Liquid Effluents. 1998. *Managing Liquid Effluents*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/0q/0q00t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Managing Nonradioactive Chemical Waste. 1998. *Managing Nonradioactive Chemical Waste*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/0f/0f00t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Event Reporting. 1997. *Event Reporting*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/27/2700t010.htm>). Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Service Request Process. 1997. *Service Request Process*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/97/9700t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

SBMS, Working with Chemicals. 1997. Working With Chemicals. Standards-Based Management System Subject Area (<http://pnl.gov:2080/standard/03/0300t010.htm>), Pacific Northwest National Laboratory, Richland, Washington.

Thompson, C. J., M.Y. Ballinger, E. G. Damberg, and R. G. Riley. 1997. *Characterization and Monitoring of 300 Area Facility Liquid Waste Streams During 1994 and 1995*. Pacific Northwest National Laboratory, Richland, Washington.

WAC 1994. *Radiation Protection - Air Emissions*, WAC 246-247, Washington Administrative Code. Washington Department of Health.

WDOE and WDOH 1998. *Hanford Site Air Operating Permit*, HNF-AOP-97-1. Washington State Department of Ecology and Washington State Department of Health.

WHC 1989. *Waste Stream Characterization Report*, WHC-EP-0287. Westinghouse Hanford Company. Richland, Washington.

4.0 Laboratory Analyses

This section provides information on the analytical laboratories and procedures used to analyze samples collected in support of the PNNL effluent monitoring program. As stated in previous sections, these samples may contain radioactivity associated with emissions from the 331 Facility main stack, or chemicals or chemical parameters associated with the 331 aquaculture outfall or PS.

Section 3.5 describes the types of samples collected by the 331 Building main stack sampling system. These samples are for particulate radionuclides on filter paper. Also liquid effluent samples are collected routinely from the 331 aquaculture system and periodically from the 331 PS. The laboratories and procedures used to perform sample analyses are described in Section 4.1. Section 4.2 provides a description of procedures employed by PNNL and its supporting analytical laboratories.

4.1 Analytical Procedures

Analytical procedures for alpha and beta particulate radioactivity, isotopic analysis, and chemical contaminants in liquid samples are provided in this section. The principal radionuclides in 331 Building emissions are described in Section 3.0. These radionuclides are detectable using procedures described in this section. Analyses are performed by the Radioanalytical Application Team (RAT) of the PNNL Radiochemical Processing Group located in the Radiochemical Processing Laboratory (RPL). All analytical work associated with radionuclide sampling is performed according to required methods per PNNL contract and statement of work (SOW) with the analytical laboratory. The SOW is prepared to meet the QA requirements from 40 CFR 61 (EPA 1990).

4.1.1 Determination of Alpha and Beta Activity on Particulate Air Filters

Particulate air filter samples from the 331 Building Main Stack are collected on a frequency as described in Section 3.2.4. The samples are initially delivered to a laboratory operated by PNNL's Radiation Protection Section. The samples are held at the laboratory to allow for adequate decay of radon daughter radionuclides.

Following the hold time for radon daughter decay, each particulate filter is delivered to the RPL RAT. Analytical services are performed according to documented requirements in a statement of work (SOW).

Samples are received, logged in, classified, and analyzed according to procedures documented as Standard Operating Procedures (SOPs).

The RPL RAT particulate alpha and beta analysis method are documented in RAT SOPs. Samples are counted on an alpha and beta proportional counter. The counters are operated with a full open energy window and are calibrated using ^{239}Pu and ^{90}Sr sources corrected for self-absorption. As specified in the SOW, required detection levels are 1-pCi/sample alpha and 38-pCi/sample beta activity on a single (2-week sample) filter for Type I and Type II errors of 0.05. Section 3.5 addresses the performance capability of the particulate emission sampling program in terms of detectable offsite dose.

4.1.2 Isotopic Analysis

The record particulate filters analyzed by RAT for alpha and beta, as discussed in Section 4.1.1 are further analyzed for radionuclides contributing 10% or more to the PTE. These analyses are performed by RAT on particulate samples composited on a semi-annual basis.

The RAT composite preparation and analysis methods used for the above isotopes are listed in Table 4.1. As specified in the SOW, required detection levels are also listed in Table 4.1.

Before digesting the particulate filters for isotopic analysis, the filters are grouped on a semi-annual basis in preparation for gamma scan analysis. The semi-annual groups of samples are transferred to a standard geometry container for counting on the gamma detectors. Intrinsic Germanium (high-purity germanium [HPGE]) detectors are used to detect isotopes with gamma ray energies between 60 and 2000 KeV.

Table 4.1 Isotopic Separation and Analysis Methods

Method	MDA (pCi/sample)
Air Filter Preparation and Compositing	-NA-
Gamma Analysis Sample Preparation, All Matrices	38 ⁽¹⁾
Electrodeposition Procedure for the Actinides	-NA-
Strontium Determination for 6-month Filter Composites	38
Isotopic Plutonium Determination for 6-month Filter Composites	1
Isotopic Americium/Curium Determination for 6-month Filter Composites	0.7
⁽¹⁾ - Based on ¹³⁷ Cs, will depend on isotope	

Following the gamma scan, the semi-annual groups are digested and the elements of interest are separated from other elements and the sample matrix by chemistry. The ⁹⁰Sr content is determined by the chemical separation and counting of a daughter element, ⁹⁰Y. The strontium is separated from other elements chemically, then ⁹⁰Y is permitted to grow into equilibrium with the ⁹⁰Sr. The ⁹⁰Y is then separated and processed to determine the chemical recovery and counted on a low background beta proportional counter. The quantity of ⁹⁰Sr is then determined based on the quantity of the daughter ⁹⁰Y produced.

Plutonium is separated from other elements and the sample matrix by adsorption on an anion exchange column. The plutonium is then processed chemically and electroplated or coprecipitated on rare earth fluorides. Isotopic concentrations of the deposited material is determined by alpha spectrometry. Following the removal of the plutonium, the sample matrix is further processed chemically and the americium and curium removed by passing the sample through a cation exchange column. The americium and curium are eluted from the column and either electroplated or coprecipitated. As with the plutonium, isotopic concentrations of the deposited material is determined by alpha spectrometry.

4.1.3 Liquid Effluent Samples

Liquid effluent samples are collected from the 331 aquaculture outfall on a monthly basis. For pH measurements, the sample is measured in the field using procedures developed by PNNL's Effluent Management Group. For other measurements aquaculture liquid waste samples are shipped to an analytical laboratory contracted by PNNL. Analytical work is performed according to required methods per the PNNL contract and SOW with the lab.

Non-routine liquid effluent samples may also be collected from the 331 PS. Desired analyses for non-routine samples may be performed in the field, at the PNNL Effluent Monitoring laboratory, or shipped to another PNNL analytical laboratory or a commercial analytical laboratory offsite. Analytical procedures may vary depending on the sampling concern. Analyses needed to determine compliance or support compliance decisions are performed using methods designated by the appropriate regulatory agency.

4.2 Procedures

PNNL's Effluent Management Group (EM) maintains documented technical and operation procedures for all aspects of environmental monitoring. SBMS (Technical and Operations Procedures) contains the requirements for preparation, review, and approval of these procedures. EM procedures incorporate all required elements of the SBMS (Technical and Operations Procedures).

Sampling procedures include identification of applicable staff, identification of possible hazards encountered while collecting samples, emergency contacts, any applicable prerequisites to performing the work, and work instructions. The work instructions address areas such as: equipment operation; sample collection media to be used; amount of sample to be collected; and sample preservatives (as needed).

Effluent Management maintains documented chain-of-custody procedures for all samples. Procedures include provisions for transfer of samples between operational staff, to and from regulated storage areas, and to the analytical laboratory. Both PNNL and any offsite analytical services contractor implement chain-of-custody within the Laboratory.

The analytical laboratory maintains documented and approved chain-of-custody procedures for the preliminary analyses of particulate emission samples and for record analysis of particulate air filters. Radiological air emission samples are stored for eighteen months before being discarded.

4.3 References

EPA 1990. *National Emission Standards for Hazardous Air Pollutants*. 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations. 1990.

SBMS, Technical and Operations Procedures. 1997. *Technical and Operations Procedures*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/74/7400t010.htm>). Pacific Northwest National Laboratory, Richland, Washington.

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5.0 Quality Assurance Requirements

5.1 Quality Assurance Plan

A number of Quality Assurance (QA) plans were developed to address QA for the different types of effluent monitoring activities performed by PNNL, including: radiological air, chemical air and liquid effluent sampling and monitoring. These plans were integrated into one Effluent Management QA Plan in 1997. This plan addresses QA for all PNNL effluent management activities. The QA program described by the plan is based on the following general requirements and guidance:

- DOE Order 5700.6C, *Quality Assurance* (DOE 1991a)
- 10 CFR 830.120 *Quality Assurance* (DOE 1994)
- PNNL Standards-Based Management System Subject Area, *Quality Assurance Planning* (SBMS, QA Planning)
- DOE Order 5400.1, *General Environmental Protection Program* (DOE 1988)
- U.S. Environmental Protection Agency (EPA) QAMS-005/80, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*. (EPA 1980)
- American National Standards Institute/American Society for Quality Control (ANSI/ASQC) E4-1994, *American National Standard Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs* (ANSI/ASQC 1994).
- DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE 1991b).

In addition, QA requirements specified in permits and regulations, including 40 CFR 61 (EPA 1990) for PNNL effluent sampling or monitoring activities are incorporated into the QA Plan.

5.2 Internal and External Plan Review

DOE 5400.1 (DOE 1988) states that the Environmental Monitoring Plan (EMP) will be reviewed annually and updated every 3 years. As a support document to the EMP, the FEMP will also be updated every 3 years. At a minimum, the FEMP assessment will be performed annually.

5.3 References

ANSI/ASQC 1994, *American National Standard Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*. E4-1994. American National Standards Institute/American Society for Quality Control.

DOE 1988. *General Environmental Protection Program*. DOE Order 5400.1. U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C..

DOE 1991a. *Quality Assurance*. DOE 5700.6C. U.S. Department of Energy Order. U.S. Department of Energy. Washington D.C..

DOE 1991b. DOE/EH-0173T, *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance*. U.S. Department of Energy. Washington D.C..

DOE 1994. *Quality Assurance*. 10 CFR 830.120. Department of Energy, U.S. Code of Federal Regulations.

EPA 1980. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*. QAMS-005/80. U.S. Environmental Protection Agency. Washington D.C..

EPA 1990. *National Emission Standards for Hazardous Air Pollutants*. 40 CFR 61. Environmental Protection Agency, U.S. Code of Federal Regulations. 1990.

SBMS, QA Planning 1997. *Quality Assurance Planning*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/87/8700T010.htm>). Pacific Northwest National Laboratory, Richland, Washington.

USEPA 1980. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*. QAMS-005/80. U.S. Environmental Protection Agency

6.0 Program Implementation Procedures

The Hanford Site Environmental Monitoring Plan (EMP) (DOE 1997) documents the effluent-monitoring and environmental surveillance programs for the Hanford Site.

6.1 Interface with the Near-facility Environmental Monitoring Program

The EMP divides the effluent-monitoring coverage into two areas, the FEMPs and the Near-Facility Environmental Monitoring Program. The FEMPs cover the monitoring of effluents from facilities at the facility. PNNL's Effluent Management Project maintains implementation procedures for all PNNL facility-monitoring activities. These procedures meet the PNNL requirements for technical and operating procedures (SBMS, Technical and Operations Procedures) and ensure that facility effluent sampling and monitoring is conducted compliantly. The Near-Facility program monitors air, surface water, groundwater, soil, sediment, vegetation, and biota around site facilities to evaluate the adequacy of effluent control at various facilities at the Hanford Site. The program is conducted by Waste Management Federal Services, Inc. Northwest Operations (WMNW).

6.2 Interface with the Operational Environmental Surveillance Program

Environmental surveillance of the 300 Area and the surrounding onsite and offsite areas is performed by the PNNL Hanford Site Surface Environmental Surveillance Project and the PNNL Site-Wide Groundwater Monitoring Project. These projects are notified in the event of actual or apparent new or off-normal discharges to the soil, surface waters, or air so they can assist in assessing their environmental and compliance significance. The data from these programs are also useful to verify the occurrence or nonoccurrence of facility releases. These surveillance projects are described in detail in DOE (1997).

6.3 References

DOE 1997. *Environmental Monitoring Plan, United States Department of Energy, Richland Operations Office*. DOE/RL-91-50, Rev. 2, U. S. Department of Energy, Richland Washington.

SBMS, Technical and Operations Procedures. 1997. *Technical and Operations Procedures*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/74/7400t010.htm>). Pacific Northwest National Laboratory, Richland, Washington.

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7.0 Reporting

This section describes the compliance reporting and notification requirements related to facility effluent monitoring activities for the 331 Complex. It also identifies the requirements and provides an overview of the procedural steps for the notification, investigation, and reporting of all environmental off-normal events for PNNL operations.

7.1 Routine Effluent Monitoring Reports

On a periodic basis, effluent monitoring data are gathered by PNNL on specific DOE Richland Operations Office (DOE-RL) facilities for compilation and reporting to DOE and the various regulatory agencies.

The following effluent monitoring reports are submitted to regulatory agencies:

Airborne Effluent

- An Annual NESHAP Air Emissions Report for the Hanford Site providing the required annual emissions measurements and climatological data is submitted to the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Health (WDOH) for the Hanford Site radioactive airborne emissions;
- The Annual Radioactive Effluent and Onsite Discharge Data Report is submitted to DOE-Headquarters, the EPA, and WDOH through DOE-RL after compilation by EG&G Idaho; and
- Semiannual Reports providing updates of compliance related activities under the Hanford Air Operating Permit (AOP) (WDOE and WDOH 1999) are submitted to WDOE.
- The Annual Compliance Certification is provided to WDOE as to the continuous or intermittent compliance of activities under the AOP.

Liquid Effluent

- The EPA is provided a monthly Discharge Monitoring Report (DMR) for discharges to the Columbia River from the 331 Aquaculture Outfall. This outfall is regulated as Outfall No. 013 on the Hanford Site Wide NPDES Permit WA-000374-3 (EPA 1981).
- WDOE is provided an annual report on significant discharges of hydrotest, maintenance, or construction wastewater discharged to ground as required by permit ST-4508 (WDOE 1997).
- WDOE is provided an annual inventory of miscellaneous liquid effluent discharges to ground as required by WDOE Consent Order DE 91NM-177 (WDOE 1991).

Other

- WDOE is provided with a monthly status report of all reportable spills from the previous month through DOE-RL.

7.2 Non-routine Notifications and Reports

There are a number of reports, including notification reports, that are required with respect to effluent monitoring activities.

- A Notice of Construction (NOC) for radioactive air emissions must be provided to WDOH whenever a new emission unit is to be created, or if there is to be significant modification to an existing emission unit. An NOC must be provided to WDOE for chemical emissions exceeding permit (No. 97NM-147) limits.
- A Notice of Transient or Abnormal Conditions must be provided to WDOH as soon as practicable in accordance with AOP requirements. A Notification Follow-up Report may also be requested in addition to the initial notification.

- Report of Closure shall be submitted to WDOH whenever an emission unit covered under WAC 246-247 (WAC 1994) ceases emission.
- Notification of Renovation/Demolition Activities Involving Asbestos must be provided to BCAA anytime work involving renovation or demolition activities in a facility with asbestos is planned.

7.3 Event Notification and Reporting

"Events" or conditions may adversely affect DOE or contractor personnel, the public, property, the environment, or the DOE mission. Staff who discover an event that requires mitigation must notify the Battelle single-point-contact to begin the response and mitigation process. Managers who are notified of events within their domain participate in the recovery, evaluation, analysis, and corrective action of the event. These two processes, staff notification and management participation, are described in a PNNL Standards-Based Management System (SBMS) Subject Area (SBMS, Event Reporting). The Subject Area incorporates requirements from DOE 232.1A, "Occurrence Reporting and Processing of Operations Information" (DOE 1997) and associated DOE-RL Directives (RLIDS).

7.4 References

SBMS, Event Reporting. 1997. *Event Reporting*. Standards-Based Management System Subject Area (<http://sbms.pnl.gov:2080/standard/27/2700t010.htm>). Pacific Northwest National Laboratory, Richland, Washington.

DOE 1997. *Occurrence Reporting and Processing of Operations Information*, DOE 232.1A. U.S. Department of Energy Order. U.S. Department of Energy.

EPA 1981. *National Pollutant Discharge Elimination System Permit*. NPDES WA-000374-3. U.S. Environmental Protection Agency

WAC 1994. *Radiation Protection - Air Emissions*, WAC 246-247, Washington Administrative Code. Washington Department of Health.

WDOE 1991. *Consent Order in the Matter of the Compliance by United States Department of Energy with Chapter 70.105 and 90.48 RCW and the Rules and Regulations of the Department of Ecology*, DE 91NM-177. Washington State Department of Ecology

WDOE 1997. *State Waste Discharge Permit for the Discharge of Hydrotest, Maintenance, and Construction Discharges*, ST-4508. Washington State Department of Ecology

WDOE and WDOH 1999. *Hanford Site Air Operating Permit*, HNF-AOP-97-1. Washington State Department of Ecology and Washington State Department of Health

Appendix A

Projection of Offsite Emission Dose

DOE Order 5400.1 states that Environmental Monitoring Plans (EMP) "shall be prepared for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials" (DOE Order 5400.1, IV-2). To support the EMP, Facility Effluent Monitoring Plans (FEMPs) are being prepared for those facilities that have the potential to release significant pollutants or hazardous materials. A methodology has been developed to determine whether potential releases of radioactive material are significant. This method is that same as that used to determine whether monitoring is required for the National Emission Standards for Hazardous Air Pollutants (NESHAP - U.S. Code of Federal Regulations, Title 40 Part 61, Subpart H) and is described in *Radionuclide Monitoring Requirements at Pacific Northwest National Laboratory - 1995*. (Ballinger et al. 1995, PNL-10855).

The first step in the method (called the FEMP Determination when used to determine whether or not a FEMP is needed for a facility) is to obtain a listing of the facility inventory. The inventory includes the radionuclide, isotope, quantity, and form. Form can be gas, liquid or powder, solid (nondispersible), contained (in sealed sourced or DOT containers), or exempt (sealed sources meeting certain criteria). At PNNL, radioactive source and material information is maintained using three separate inventory systems: (1) facilities management radioactive materials inventory, (2) composite radioactive materials inventory, and (3) nuclear materials inventory. An identifier on the inventory listing indicates the inventory system that the information was obtained from. Additional detail on the FEMP Determination method is provided in PNL-10855. A table is provided showing a listing by nuclide if the radioactive material inventory in 331. The table shows the total activity and the percent contribution to the total unabated Potential-to-Emit for the facility.

Table A.1

FEMP Dose Contribution by Nuclide for: 331 Building

Total PTE Dose: 4.30E-01 mrem/yr

Nuclide	Inventory (Ci)	Dose (mrem/yr)	% Total	Nuclide	Inventory (Ci)	Dose (mrem/yr)	% Total
Am-241	2.91E-02	8.43E-03	1.96%				
Am-243	2.36E-01	6.85E-02	15.94%				
Ba-133	6.55E-03	7.65E-08	0.00%				
C-14	2.64E-02	1.32E-06	0.00%				
Ce-144	3.00E-05	1.11E-08	0.00%				
Co-57	4.00E-05	2.44E-09	0.00%				
Co-58	1.00E-09	1.20E-13	0.00%				
Co-60	4.90E+04	1.00E-07	0.00%				
Cs-134	5.00E-05	1.05E-07	0.00%				
Cs-137	8.01E-02	2.45E-07	0.00%				
Eu-152	1.20E-02	4.90E-11	0.00%				
Eu-154	2.00E-05	8.00E-08	0.00%				
Eu-155	2.00E-05	3.40E-09	0.00%				
H-3	2.60E-02	1.07E-08	0.00%				
I-125	1.00E-05	2.80E-08	0.00%				
Mn-54	5.00E-05	1.70E-08	0.00%				
Ni-63	6.00E-02	0.00E+00	0.00%				
Np-237	1.50E-02	3.89E-03	0.91%				
Pu-238	1.73E+00	3.11E-01	72.48%				
Pu-239	4.35E-01	3.73E-02	8.68%				
S-35	2.00E-03	1.24E-08	0.00%				
Sb-125	2.00E-05	1.08E-08	0.00%				
Sr-90	3.66E-03	1.27E-07	0.00%				
Tc-97	4.25E-02	5.53E-09	0.00%				
Tc-99	4.89E-03	2.48E-06	0.00%				
Th-230	3.00E-09	0.00E+00	0.00%				
Th-232	5.39E-05	1.00E-05	0.00%				
U(20%)	9.36E-10	6.27E-11	0.00%				
U(Dep)	6.44E-05	3.99E-06	0.00%				
U(Nat)	2.11E-03	1.31E-04	0.03%				
U-235	2.93E-05	1.96E-06	0.00%				
U-238	1.36E-04	4.87E-08	0.00%				
Y-88	1.00E-12	4.90E-15	0.00%				

FEMP Dose Contribution by Nuclide for: 331G Building

Total PTE Dose: 2.39E-08 mrem/yr

Nuclide	Inventory (Ci)	Dose (mrem/yr)	% Total	Nuclide	Inventory (Ci)	Dose (mrem/yr)	% Total
C-14	1.00E-04	5.00E-09	20.90%				
H-3	2.00E-03	8.20E-10	3.43%				
P-32	1.00E-04	5.70E-09	23.83%				
S-35	2.00E-03	1.24E-08	51.84%				

FEMP Dose Contribution by Nuclide for: 331H Building

Total PTE Dose: 0.00E+00 mrem/yr

Nuclide	Inventory (Ci)	Dose (mrem/yr)	% Total	Nuclide	Inventory (Ci)	Dose (mrem/yr)	% Total
Kr-85	1.70E-02	0.00E+00					
Ni-63	1.50E-02	0.00E+00					

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Appendix B

Nonradioactive Hazardous Materials Characterization

DOE Order 5400.1 states that Environmental Monitoring Plans (EMP) "shall be prepared for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials" (DOE Order 5400.1, IV-2). The Facility Effluent Monitoring Plans (FEMPs) being prepared to support the EMP include the consideration of nonradioactive hazardous materials.

A listing of the chemicals used in the building is obtained using the PNL Chemical Management System (CMS). The inventory information includes the location, chemical name, and quantity. In some cases the manufacturer and individual container quantities are also tracked. In addition, the CMS data includes the reportable quantity (RQ) of the chemical. RQs are obtained from 40 CFR 302 and are the amounts which, if released to the environment from a facility, require notification to the National Response Center. To characterize the relative hazard of the building, a summary table, Table B.1, is prepared showing those chemicals that are reported to be present in greater than RQ amounts. Table B.2 provides a list of all chemicals found in the 331 Complex which have an RQ amount.

Table B.1.
CMS Reportable Quantity Inventory Listing
Above 100 % of Reportable Quantity – 12/98

For: 331-LIFE SCIENCES LABORATORY I

<u>RQ Grp</u>	<u>Chemical Name</u>	<u>CAS No.</u>	<u>Quantity Units</u>	<u>RQ Value</u>
QX	ARSENENOUS ACID, SODIUM SALT (9CI)	7784-46-5	1.64 LBS	1 LB
QX	SILVER NITRATE	7761-88-8	1.61 LBS	1 LB
QX	SODIUM ARSENATE	7631-89-2	2.00 LBS	1 LB
QA	CARBON TETRACHLORIDE	56-23-5	19.62 LBS	10 LBS
QA	CHLOROFORM	67-66-3	75.10 LBS	10 LBS
QA	TRIS	126-72-7	33.26 LBS	0 LBS

Last updated 11/29/98.

Send questions or comments to the CMS Support Team.

For: 331C-FACILITY STORAGE BUILDING

<u>RQ Grp</u>	<u>Chemical Name</u>	<u>CAS No.</u>	<u>Quantity Units</u>	<u>RQ Value</u>
<i>No Chemicals above 100% of Reportable Quantity.</i>				

Last updated 11/29/98.

Send questions or comments to the CMS Support Team.

For: 331D-BIOMAGNETIC EFFECTS LABORATORY

<u>RQ Grp</u>	<u>Chemical Name</u>	<u>CAS No.</u>	<u>Quantity Units</u>	<u>RQ Value</u>
<i>No Chemicals above 100% of Reportable Quantity.</i>				

Last updated 11/29/98.

Send questions or comments to the CMS Support Team.

For: 331H-AEROSOL WIND TUNNEL RESEARCH FACILITY

<u>RQ Grp</u>	<u>Chemical Name</u>	<u>CAS No.</u>	<u>Quantity Units</u>	<u>RQ Value</u>
<i>No Chemicals above 100% of Reportable Quantity.</i>				

Last updated 11/29/98.

Send questions or comments to the CMS Support Team.

Table B.2.
CMS Reportable Quantity Inventory Listing
Above 0 % of Reportable Quantity – 12/98

For: 331-LIFE SCIENCES LABORATORY I

RQ Grp	Chemical Name	CAS No.	Quantity Units	RQ Value
QX	9,10-DIMETHYLBENZ(A)ANTHRACENE	57-97-6	0.00 LBS	1 LB
QX	ARSENENOUS ACID, SODIUM SALT (9CI)	7784-46-5	1.64 LBS	1 LB
QX	ARSENIC PENTOXIDE	1303-28-2	0.22 LBS	1 LB
QX	ARSENIC TRIOXIDE	1327-53-3	0.44 LBS	1 LB
QX	BERYLLIUM FLUORIDE	7787-49-7	0.06 LBS	1 LB
QX	CACODYLIC ACID	75-60-5	0.39 LBS	1 LB
QX	N-NITROSODIETHYLAMINE	55-18-5	0.07 LBS	1 LB
QX	SILVER NITRATE	7761-88-8	1.61 LBS	1 LB
QX	SODIUM ARSENATE	7631-89-2	2.00 LBS	1 LB
QX	STREPTOZOTICIN	18883-66-4	0.00 LBS	1 LB
QA	2,6-DINITRO-N,N-DIPROPYL-4-(TRIFLUOROMET	1582-09-8	0.00 LBS	10 LBS
QA	2,7-NAPHTHALENEDISULFONIC ACID, 3,3'-[(3	72-57-1	1.70 LBS	10 LBS
QA	AMINOTRIAZOLE	61-82-5	0.35 LBS	10 LBS
QA	AMMONIUM CHROMATE	7788-98-9	1.00 LBS	10 LBS
QA	BENZENE	71-43-2	2.58 LBS	10 LBS
QA	CADMIUM	7440-43-9	0.55 LBS	10 LBS
QA	CADMIUM CHLORIDE	10108-64-2	4.85 LBS	10 LBS
QA	CALCIUM HYPOCHLORITE, DRY, INCLUDING MIX	7778-54-3	0.44 LBS	10 LBS
QA	CARBON TETRACHLORIDE	56-23-5	19.62 LBS	10 LBS
QA	CHLOROFORM	67-66-3	75.10 LBS	10 LBS
QA	CHROMIUM (VI) OXIDE	1333-82-0	0.02 LBS	10 LBS
QA	COPPER(II) CHLORIDE	7447-39-4	1.33 LBS	10 LBS
QA	CUPRIC SULFATE	7758-98-7	1.61 LBS	10 LBS
QA	HEXACHLOROBENZENE	118-74-1	0.01 LBS	10 LBS
QA	LEAD	7439-92-1	1.06 LBS	10 LBS
QA	LEAD CHLORIDE	7758-95-4	1.06 LBS	10 LBS
QA	LEAD NITRATE	10099-74-8	2.77 LBS	10 LBS
QA	MERCURY (II) THIOCYANATE	592-85-8	0.22 LBS	10 LBS
QA	N-METHYL-N'-NITRO-N-NITROSOGUANIDINE	70-25-7	0.11 LBS	10 LBS
QA	PENTACHLOROPHENOL	87-86-5	0.07 LBS	10 LBS
QA	POTASSIUM CHROMATE	7789-00-6	0.17 LBS	10 LBS
QA	POTASSIUM CYANIDE	151-50-8	0.22 LBS	10 LBS
QA	POTASSIUM DICHROMATE	7778-50-9	4.13 LBS	10 LBS
QA	SELENIUM(IV) OXIDE	7446-08-4	0.22 LBS	10 LBS
QA	SELENOUS ACID	7783-00-8	0.22 LBS	10 LBS
QA	SODIUM CHROMATE	7775-11-3	0.60 LBS	10 LBS
QA	SODIUM DICHROMATE	10588-01-9	2.00 LBS	10 LBS
QA	TRIS	126-72-7	33.26 LBS	10 LBS
QB	1,1,1,2-TETRACHLOROETHANE	630-20-6	0.00 LBS	100 LBS
QB	1,1,2-TRICHLOROETHANE	79-00-5	0.17 LBS	100 LBS
QB	3-METHYLPHENO	108-39-4	0.23 LBS	100 LBS
QB	4-HYDROXYTOLUENE	106-44-5	0.22 LBS	100 LBS
QB	4-NITROPHENOL	100-02-7	0.29 LBS	100 LBS
QB	ACENAPHTHENE	83-32-9	0.01 LBS	100 LBS
QB	ACETAMIDE	60-35-5	0.01 LBS	100 LBS

Table B.2.
CMS Reportable Quantity Inventory Listing
Above 0 % of Reportable Quantity – 12/98

QB	AMMONIUM FLUORIDE	12125-01-8	2.00 LBS	100 LBS
QB	AMMONIUM SULFIDE	12135-76-1	0.15 LBS	100 LBS
QB	BIPHENYL	92-52-4	3.96 LBS	100 LBS
QB	BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	0.00 LBS	100 LBS
QB	BROMOFORM	75-25-2	0.23 LBS	100 LBS
QB	CARBON DISULFIDE	75-15-0	1.39 LBS	100 LBS
QB	CATECHOL	120-80-9	0.16 LBS	100 LBS
QB	CRESOL, O-	95-48-7	0.22 LBS	100 LBS
QB	CUPRIC NITRATE	3251-23-8	1.13 LBS	100 LBS
QB	CYSTEINE, N-ACETYL-, L-	63-25-2	2.20 LBS	100 LBS
QB	DIBROMOCHLOROMETHANE	124-48-1	0.00 LBS	100 LBS
QB	DIETHANOLAMINE	111-42-2	0.55 LBS	100 LBS
QB	DIMETHYL SULFATE	77-78-1	0.31 LBS	100 LBS
QB	DIMETHYLFORMAMIDE	68-12-2	5.20 LBS	100 LBS
QB	ETHYL ETHER	60-29-7	29.84 LBS	100 LBS
QB	ETHYLENE DICHLORIDE	107-06-2	16.60 LBS	100 LBS
QB	FERROUS CHLORIDE	7758-94-3	2.78 LBS	100 LBS
QB	FORMALDEHYDE	50-00-0	16.77 LBS	100 LBS
QB	HYDROFLUORIC ACID		1.01 LBS	100 LBS
QB	HYDROQUINONE	123-31-9	1.11 LBS	100 LBS
QB	ISOFLUORPHATE	55-91-4	0.00 LBS	100 LBS
QB	NAPHTHALENE	91-20-3	0.77 LBS	100 LBS
QB	NICKEL	7440-02-0	0.11 LBS	100 LBS
QB	NICKEL (II) SULFATE	7786-81-4	2.76 LBS	100 LBS
QB	NICKEL NITRATE	14216-75-2	1.00 LBS	100 LBS
QB	NICKEL(II) CHLORIDE	7718-54-9	1.05 LBS	100 LBS
QB	NICOTINE	54-11-5	0.06 LBS	100 LBS
QB	PENTACHLORONITROBENZENE	82-68-8	0.00 LBS	100 LBS
QB	PHOSPHORIC ACID, DIETHYL P-NITROPHENYL E	311-45-5	0.00 LBS	100 LBS
QB	POTASSIUM PERMANGANTE	7722-64-7	7.06 LBS	100 LBS
QB	PROPYLENE OXIDE	75-56-9	1.73 LBS	100 LBS
QB	SELENIUM	7782-49-2	0.32 LBS	100 LBS
QB	SODIUM NITRITE	7632-00-0	4.12 LBS	100 LBS
QB	SODIUM SELENITE	10102-18-8	2.47 LBS	100 LBS
QB	TRICHLOROETHYLENE	79-01-6	19.47 LBS	100 LBS
QB	TRIMETHYLAMINE	75-50-3	0.51 LBS	100 LBS
QB	URANYL ACETATE	541-09-3	0.06 LBS	100 LBS
QB	URETHANE 99%	51-79-6	16.70 LBS	100 LBS
QB	VINYLDENE CHLORIDE	75-35-4	0.00 LBS	100 LBS
QB	XYLENE	1330-20-7	79.18 LBS	100 LBS
QB	XYLENE, P-	106-42-3	8.55 LBS	100 LBS
QC	1,1,1-TRICHLOROETHANE	71-55-6	0.59 LBS	1000 LBS
QC	2,2,4-TRIMETHYLPENTANE, HYDROCARBON KIT	540-84-1	7.62 LBS	1000 LBS
QC	AMMONIUM HYDROXIDE	1336-21-6	34.54 LBS	1000 LBS
QC	CHLOROACETALDEHYDE	107-20-0	0.01 LBS	1000 LBS
QC	CHROMIUM(II)CHLORIDE	10049-05-5	1.11 LBS	1000 LBS
QC	CYANOGEN BROMIDE	506-68-3	0.03 LBS	1000 LBS

Table B.2.
CMS Reportable Quantity Inventory Listing
Above 0 % of Reportable Quantity – 12/98

QC	CYCLOHEXANE	110-82-7	1.94 LBS	1000 LBS
QC	FERRIC NITRATE CRYSTALLINE AR GRADE	10421-48-4	1.00 LBS	1000 LBS
QC	FERROUS AMMONIUM SULFATE HEXAHYDRATE	10045-89-3	1.85 LBS	1000 LBS
QC	GLYCOL ETHER	110-80-5	10.61 LBS	1000 LBS
QC	HYDROGEN PEROXIDE	7722-84-1	3.08 LBS	1000 LBS
QC	IRON (III) AMMONIUM CITRATE	1185-57-5	1.10 LBS	1000 LBS
QC	IRON(II) SULFATE	7720-78-7	4.20 LBS	1000 LBS
QC	IRON(III) CHLORIDE	7705-08-0	4.36 LBS	1000 LBS
QC	M-XYLENE	108-38-3	0.26 LBS	1000 LBS
QC	METHYL TERT-BUTYL ETHER	1634-04-4	15.64 LBS	1000 LBS
QC	METHYLENE BROMIDE	74-95-3	0.11 LBS	1000 LBS
QC	METHYLENE CHLORIDE	75-09-2	54.29 LBS	1000 LBS
QC	NITRIC ACID	7697-37-2	80.03 LBS	1000 LBS
QC	O-XYLENE	95-47-6	20.02 LBS	1000 LBS
QC	OSIUM TETROXIDE	20816-12-0	0.01 LBS	1000 LBS
QC	PARAFORMALDEHYDE	30525-89-4	1.10 LBS	1000 LBS
QC	PHENOL	108-95-2	21.15 LBS	1000 LBS
QC	POTASSIUM HYDROXIDE	1310-58-3	26.08 LBS	1000 LBS
QC	PYRIDINE SILYLATION GRADE	110-86-1	7.48 LBS	1000 LBS
QC	SILVER	7440-22-4	0.35 LBS	1000 LBS
QC	SODIUM AZIDE	26628-22-8	2.68 LBS	1000 LBS
QC	SODIUM FLUORIDE	7681-49-4	3.47 LBS	1000 LBS
QC	SODIUM HYDROXIDE	1310-73-2	87.22 LBS	1000 LBS
QC	SULFURIC ACID	7664-93-9	91.95 LBS	1000 LBS
QC	TETRAHYDROFURAN	109-99-9	5.87 LBS	1000 LBS
QC	TOLUENE	108-88-3	63.31 LBS	1000 LBS
QC	TRANS-1,2-DICHLOROETHENE	156-60-5	0.00 LBS	1000 LBS
QC	VANADIUM SULFATE	27774-13-6	0.04 LBS	1000 LBS
QC	ZINC ACETATE	557-34-6	2.20 LBS	1000 LBS
QC	ZINC CHLORIDE	7646-85-7	8.37 LBS	1000 LBS
QC	ZINC FORMATE	557-41-5	0.00 LBS	1000 LBS
QC	ZINC NITRATE	7779-88-6	1.00 LBS	1000 LBS
QC	ZINC SULFATE	7733-02-0	2.20 LBS	1000 LBS
QD	1,4-NAPHTHALENEDIONE	130-15-4	0.02 LBS	5000 LBS
QD	ACETIC ACID	64-19-7	91.50 LBS	5000 LBS
QD	ACETIC ANHYDRIDE	108-24-7	2.25 LBS	5000 LBS
QD	ACETONE	67-64-1	207.06 LBS	5000 LBS
QD	ACETONITRILE	75-05-8	351.83 LBS	5000 LBS
QD	ACETOPHENONE	98-86-2	0.57 LBS	5000 LBS
QD	ACRYLAMIDE	79-06-1	22.46 LBS	5000 LBS
QD	ALUMINUM SULPHATE	10043-01-3	0.22 LBS	5000 LBS
QD	AMMONIUM ACETATE	631-61-8	40.37 LBS	5000 LBS
QD	AMMONIUM BICARBONATE	1066-33-7	5.50 LBS	5000 LBS
QD	AMMONIUM CARBAMATE	1111-78-0	0.06 LBS	5000 LBS
QD	AMMONIUM CHLORIDE	12125-02-9	10.86 LBS	5000 LBS
QD	AMMONIUM CITRATE, DIBASIC	3012-65-5	1.70 LBS	5000 LBS
QD	ANTHRACENE	120-12-7	0.05 LBS	5000 LBS

Table B.2.
CMS Reportable Quantity Inventory Listing
Above 0 % of Reportable Quantity – 12/98

QD	ANTIMONY	7440-36-0	1.10 LBS	5000 LBS
QD	BENZOIC ACID	65-85-0	0.80 LBS	5000 LBS
QD	COPPER	7440-50-8	0.11 LBS	5000 LBS
QD	CYCLOHEXANONE	108-94-1	1.94 LBS	5000 LBS
QD	DICHLOROBROMOMETHANE	75-27-4	0.11 LBS	5000 LBS
QD	DICHLORODIFLUOROMETHANE	75-71-8	3.73 LBS	5000 LBS
QD	DIMETHYL PHTHALATE	131-11-3	0.00 LBS	5000 LBS
QD	ETHYL ACETATE	141-78-6	59.44 LBS	5000 LBS
QD	ETHYLENE GLYCOL	107-21-1	24.49 LBS	5000 LBS
QD	FLUORENE	86-73-7	0.01 LBS	5000 LBS
QD	FORMIC ACID	64-18-6	3.93 LBS	5000 LBS
QD	FUMARIC ACID	110-17-8	0.88 LBS	5000 LBS
QD	HEXANE	110-54-3	31.64 LBS	5000 LBS
QD	HYDROCHLORIC ACID		112.99 LBS	5000 LBS
QD	ISOBUTYL ALCOHOL	78-83-1	2.65 LBS	5000 LBS
QD	MALEIC ACID	110-16-7	5.50 LBS	5000 LBS
QD	METHYL ALCOHOL	67-56-1	352.91 LBS	5000 LBS
QD	METHYL ISOBUTYL KETONE	108-10-1	4.41 LBS	5000 LBS
QD	N-BUTYL ALCOHOL	71-36-3	53.83 LBS	5000 LBS
QD	PHENANTHRENE	85-01-8	0.22 LBS	5000 LBS
QD	PHOSPHORIC ACID	7664-38-2	22.62 LBS	5000 LBS
QD	PYRENE	129-00-0	0.05 LBS	5000 LBS
QD	QUINOLINE	91-22-5	0.22 LBS	5000 LBS
QD	SODIUM BISULFITE	7631-90-5	2.32 LBS	5000 LBS
QD	SODIUM PHOSPHATE DIBASIC	7558-79-4	53.79 LBS	5000 LBS
QD	TRICHLOROFLUOROMETHANE	75-69-4	0.38 LBS	5000 LBS
QD	TRIETHYLAMINE	121-44-8	1.24 LBS	5000 LBS
QD	ZIRCONIUM NITRATE	13746-89-9	0.06 LBS	5000 LBS

Last updated 11/29/98.
Send questions or comments to the CMS Support Team.

For: 331C-FACILITY STORAGE BUILDING				
<u>RQ Grp</u>	<u>Chemical Name</u>	<u>CAS No.</u>	<u>Quantity Units</u>	<u>RQ Value</u>
QD	METHYL ALCOHOL	67-56-1	0.87 LBS	5000 LBS

Last updated 11/29/98.
Send questions or comments to the CMS Support Team.

For: 331D-BIOMAGNETIC EFFECTS LABORATORY				
<u>RQ Grp</u>	<u>Chemical Name</u>	<u>CAS No.</u>	<u>Quantity Units</u>	<u>RQ Value</u>
<i>No Chemicals above 0% of Reportable Quantity.</i>				

Last updated 11/29/98.
Send questions or comments to the CMS Support Team.

Table B.2.
CMS Reportable Quantity Inventory Listing
Above 0 % of Reportable Quantity – 12/98

For: 331H-AEROSOL WIND TUNNEL RESEARCH FACILITY				
<u>RQ Grp</u>	<u>Chemical Name</u>	<u>CAS No.</u>	<u>Quantity Units</u>	<u>RQ Value</u>
QB	BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	1.10 LBS	100 LBS
QB	XYLENE	1330-20-7	0.45 LBS	100 LBS
QC	SODIUM HYDROXIDE	1310-73-2	0.83 LBS	1000 LBS
QD	ACETONE	67-64-1	0.35 LBS	5000 LBS
QD	COPPER	7440-50-8	9.00 LBS	5000 LBS
QD	METHYL ALCOHOL	67-56-1	27.15 LBS	5000 LBS
QD	N-BUTYL ALCOHOL	71-36-3	1.78 LBS	5000 LBS

Last updated 11/29/98.
Send questions or comments to the CMS Support Team.

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Appendix C

Supporting Calculations

	Particles	Composite Samples
Lab Corr Factor	0.85	1
Op Factor	1	1
Media Factor	0.91	0.91
Sampler Flow	3.60 cfm	3.60 cfm
Stack Flow	65,500 cfm	65,500 cfm
Transp. Factor	0.95	0.95

Detectable Release = $\frac{(\text{MDA} / \text{Yr fraction}) \times (\text{stack flow/sample flow}) \times 1\text{E-12}}{\text{Lab Corr. factor} \times \text{Op. Factor} \times \text{Transport Factor} \times \text{Media Factor}}$

Radionuclide	MDA (pCi/sample)	Detectable Annual Release (Ci)	Unit Dose mrem/Ci	Emission for 0.01 mrem (Ci)	Yr Fraction	
Beta Activity	38	2.4E-05	4.9	2.0E-03	3.85E-02	2 wk sample
Alpha Activity	1	6.4E-07	180	5.6E-05	3.85E-02	2 wk sample
Pu-238	1	4.2E-08	180	5.6E-05	5.00E-01	6 mo. Sample
Pu-239/240	1	4.2E-08	200	5.0E-05	5.00E-01	6 mo. Sample

Minimum Detectable Particulate Concentration

Detectable Concentration = $\frac{(\text{MDA}) \times 1\text{E-12}}{\text{Lab Corr. factor} \times \text{Transport Factor} \times \text{Media Factor} \times \text{sampler flow} \times \text{time}}$

3.6 CFM =	101941.2	cm3/min			
time (2 weeks) =	20160	min			
	Alpha	6.6E-22	Ci/cm3 =	6.6E-16	uCi/cm3
	Beta	2.5E-20	Ci/cm3 =	2.5E-14	uCi/cm3

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Appendix D

Facility Effluent Pathway Drawings

Current copies of the Essential Drawings related to effluent pathways are included in this appendix. These drawings are current as of publishing this document. The official up-to-date version can be obtained from Battelle Engineering Files.

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DRAWING INDEX

DRAWING NUMBER	DESCRIBE	INDEX NO	DRAWING TITLE
H-3-307794	GENERAL	0100	GENERAL TITLE SHEET AND DRAWING LIST
H-3-307795	CIVIL	0100/2001	PIPING SITE PLAN SERVICES
H-3-307796	PIPING	8408/8510	SANITARY DRAIN AND DETAILS (331H)
H-3-307797	PIPING	8408/8510	SANITARY DRAIN AND DETAILS (331G)
H-3-307798 SH 1	PIPING	8510/8900	RIVER OUTFALL DRAIN FIRST FLOOR AREA 1 PLAN
H-3-307798 SH 2	PIPING	8510/8900	RIVER OUTFALL DRAIN SECOND FLOOR AREA 1 PLAN & DETAILS
H-3-307798 SH 3	PIPING	8510/8900	RIVER OUTFALL DRAIN THIRD FLOOR AREA 1 PLAN
H-3-307799 SH 1	PIPING	3510/8900	RIVER OUTFALL DRAIN FIRST FLOOR AREA 2 PLAN
H-3-307799 SH 2	PIPING	3510/8900	RIVER OUTFALL DRAIN SECOND FLOOR AREA 2 PLAN & DETAILS
H-3-307799 SH 3	PIPING	8510/8900	RIVER OUTFALL DRAIN THIRD FLOOR AREA 2 PLAN & DETAILS
H-3-307800 SH 1	PIPING	8510/8900	RIVER OUTFALL DRAIN FIRST FLOOR AREA 3 PLAN
H-3-307800 SH 2	PIPING	3510/8900	RIVER OUTFALL DRAIN SECOND FLOOR AREA 3 PLAN
H-3-307801 SH 1	PIPING	8510/8900	RIVER OUTFALL DRAIN FIRST FLOOR AREA 4 PLAN
H-3-307801 SH 2	PIPING	8510/8900	RIVER OUTFALL DRAIN SECOND FLOOR AREA 4 PLAN & DETAILS
H-3-307801 SH 3	PIPING	8510/8900	RIVER OUTFALL DRAIN THIRD FLOOR AREA 4 PLAN & DETAILS
H-3-307802 SH 1	PIPING	8510/8900	RIVER OUTFALL DRAIN FIRST FLOOR AREA 5 PLAN
H-3-307802 SH 2	PIPING	8510/8900	RIVER OUTFALL DRAIN SECOND FLOOR AREA 5 PLAN
H-3-307802 SH 3	PIPING	8510/8900	RIVER OUTFALL DRAIN THIRD FLOOR AREA 5 PLAN
H-3-307803 SH 1	PIPING	8510/8900	RIVER OUTFALL DRAIN FIRST FLOOR DETAILS
H-3-307803 SH 2	PIPING	8510/8900	RIVER OUTFALL DRAIN FIRST FLOOR DETAILS
H-3-307804 SH 1	PIPING	8408/8510	SANITARY DRAIN FIRST FLOOR AREA 1 PLAN
H-3-307804 SH 2	PIPING	8408/8510	SANITARY DRAIN SECOND FLOOR AREA 1 PLAN
H-3-307804 SH 3	PIPING	8408/8510	SANITARY DRAIN THIRD FLOOR AREA 1 PLAN
H-3-307805 SH 1	PIPING	8408/8510	SANITARY DRAIN FIRST FLOOR AREA 2 PLAN
H-3-307805 SH 2	PIPING	8408/8510	SANITARY DRAIN SECOND FLOOR AREA 2 PLAN
H-3-307805 SH 3	PIPING	8408/8510	SANITARY DRAIN THIRD FLOOR AREA 2 PLAN
H-3-307806 SH 1	PIPING	8408/8510	SANITARY DRAIN FIRST FLOOR AREA 4 PLAN
H-3-307806 SH 2	PIPING	8408/8510	SANITARY DRAIN SECOND FLOOR AREA 4 PLAN
H-3-307807 SH 1	PIPING	8408/8510	SANITARY DRAIN FIRST FLOOR AREA 5 PLAN
H-3-307807 SH 2	PIPING	8408/8510	SANITARY DRAIN SECOND FLOOR AREA 5 PLAN
H-3-307807 SH 3	PIPING	8408/8510	SANITARY DRAIN THIRD FLOOR AREA 5 PLAN
H-3-307808	PIPING	8408/8510	SANITARY DRAIN SECOND FLOOR DETAILS
H-3-307809 SH 1	PIPING	8407/8408	PROCESS DRAIN FIRST FLOOR AREA 1 PLAN
H-3-307809 SH 2	PIPING	8407/8408	PROCESS DRAIN SECOND FLOOR AREA 1 PLAN
H-3-307809 SH 3	PIPING	8407/8408	PROCESS DRAIN THIRD FLOOR AREA 1 PLAN
H-3-307810 SH 1	PIPING	8407/8408	PROCESS DRAIN FIRST FLOOR AREA 2 PLAN
H-3-307810 SH 2	PIPING	8407/8408	PROCESS DRAIN SECOND FLOOR AREA 2 PLAN
H-3-307810 SH 3	PIPING	8407/8408	PROCESS DRAIN THIRD FLOOR AREA 2 PLAN
H-3-307811	PIPING	8407/8408	PROCESS DRAIN FIRST FLOOR AREA 3 PLAN
H-3-307812 SH 1	PIPING	8407/8408	PROCESS DRAIN FIRST FLOOR AREA 4 PLAN
H-3-307812 SH 2	PIPING	8407/8408	PROCESS DRAIN SECOND FLOOR AREA 4 PLAN
H-3-307812 SH 3	PIPING	8407/8408	PROCESS DRAIN THIRD FLOOR AREA 4 PLAN
H-3-307813 SH 1	PIPING	8407/8408	PROCESS DRAIN FIRST FLOOR AREA 5 PLAN
H-3-307813 SH 2	PIPING	8407/8408	PROCESS DRAIN SECOND FLOOR AREA 5 PLAN
H-3-307813 SH 3	PIPING	8407/8408	PROCESS DRAIN THIRD FLOOR AREA 5 PLAN
H-3-307929 SH 1	PIPING	8407/8501	CONDENSATE DRAIN FIRST FLOOR AREA 4 PLAN
H-3-307930 SH 1	PIPING	8407/8501	CONDENSATE DRAIN FIRST FLOOR AREA 5 PLAN

AREA DESIGNATOR
SCALE NONE

SECOND FLOOR
AREA DESIGNATOR
SCALE: NONE

ABBREVIATIONS

- FLOOR DRAIN CAPPED OR PLUGGED
- FLOOR DRAIN OPEN
- FUNNEL DRAIN OR OPEN RISER DRAIN
- SINK DRAIN
- BALL VALVE
- BLIND FLANGE
- CAPPED, FLANGED OR PLUGGED LINE BELOW 1ST FLOOR
- CUP SINK
- LINE DOWN
- LINE UP
- CHECK VALVE
- THREE WAY VALVE
- GATE VALVE
- HOSE CONNECTION
- PIPE REDUCER
- FLOW ARROW
- PLUGGED LINE
- STRAINER
- THRU WALL OR FLOOR
- TRAP

A/C	-	AIR CONDITIONER
AW	-	AIR WASTE
BFP	-	BACK FLOW PREVENTER
CLG	-	CEILING
CNDS	-	CONDENSATE
CO	-	CLEAN OUT
CW	-	COLD WATER
DF	-	DRINKING FOUNTAIN
DR	-	DRAIN
EQPT	-	EQUIPMENT
EXST	-	EXISTING
FD	-	FLOOR DRAIN
FL	-	FLOOR
FUNL	-	TUNNEL
HWT	-	HOT WATER TANK
MH	-	VANHOLE
ORD	-	OVERFLOW ROOF DRAIN
PW	-	PROCESS WATER
RD	-	ROOF DRAIN
RM	-	ROOM
SD	-	STEAM DRAIN
SH	-	SHEET
SK	-	SKIM
SWG	-	SANITARY SEWER
SRV	-	SAFETY RELIEF VALVE
SSV	-	SERVICE SINK
STST	-	STAINLESS STEEL
TD	-	TRENCH DRAIN
UR	-	URINAL
V	-	VENT
VTR	-	VENT THRU ROOF
WC	-	WATER CLOSET
(X)	-	PLACES

XXX OR XXX - ROOM NUMBER

GENERAL NOTES
(UNLESS OTHERWISE NOTED)

1. PIPING SHOWN IS "AS-BUILT" AT DRAWING APPROVAL DATE.
2. THIS DRAWING PROVIDES AS-BUILT DRAINAGE PIPING AND THROUGH FIELD VERIFICATION, WHERE ACCESSIBLE, INFORMATION FROM EXISTING DRAWINGS.

AREA DESIGNATOR
SCALE: NONE

[illegible]

ND

NOTE

1 FOR GENERAL NOTES, SYMBOLS, ABBREVIATIONS
AND GENERAL DRAWING LIST, SEE H-3-307794.

RIVER

H-3-307794	GEN TITL SK & DWG LIST
H-3-307796	SANITARY DRAIN DETS (331H)
H-3-307797	SANITARY DRAIN DETS (331G)
H-3-307803	RIVER OUTFALL DRAIN DETS
DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	
NEXT USED ON	

REV	NO	DATE	BY	CHK	DATE	REV	DATE
REVISIONS							
DESCRIPTION				DATE			

U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
PIPING SITE PLAN SERVICES	
DRAWN BY: J. CASTON CHECKED BY: J. CASTON DATE: 10/16/74	FACILITY EFFLUENT MONITORING PLAN SEE: 0100 331 F 200:
H-3-307795	0

1 DETAIL
SCALE: NONE

2 DETAIL
SCALE: NONE

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

VTR

GROWTH CHAMBER
FROM BREATHING AIR TANK
FROM GROWTH CHAMBER
1/2" FROM EYE WASH

A SECTION
SCALE: NONE

1 1/2"
1/4" FROM LAB AIR TANK
VTR
3/8" FROM REFRIGERATED AIR DRYER

CD 1 000153-EDP01R2

DRAWN RP HUNTER		DATE 10/18/78		U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE	
CHECKED JL CASTON		DATE 10/18/78		PACIFIC NORTHWEST LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
APPROVED JL CASTON		DATE 10/18/78		SANITARY DRAIN AND DETAILS	
FACILITY EFFLUENT MONITORING PLAN					
SIZE 8408 8510		NO. 33141		KEY NO. H-3-30779610	

NO.	DATE	BY	DATE	DATE	DATE	DESCRIPTION
1	10/18/78	RP HUNTER				
2						
3						
4						
5						
6						
7						
8						
9						
10

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

1 DGO-83-EDP01P2

U. S. DEPARTMENT OF ENERGY RICHLAND OPERATIONS OFFICE	
PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
SANITARY DRAIN AND DETAILS	
FACILITY EFFLUENT MONITORING PLAN	
DRAWN BY: RP HUNTER CHECKED BY: J. P. Burch DESIGNED BY: J. P. Burch DATE: 10/15/78 SCALE: 1/8" = 1'-0"	PROJECT NO: 8408 DRAWING NO: 3316 SHEET NO: 8510 DATE: 10/15/78
H-3-307797 0	

H-3-307794	GEN TITLE SHEET & DN LIST	NR LF DN DATE	DEGR DATE	CH DATE	REV DATE	DESCRIPTION
REVISIONS						
CADCODE 3D:BV ACD2:13 0.55						
CADFILE H-307797A

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

SCALE: NONE

4-3-30780: RIVER OUTFALL AREA 4 PLAN 4-3-307739 RIVER OUTFALL AREA 2 PLAN 4-3-307794 GEN. TITLE SHEET & DRAWING LIST DRAWING NO. DRAWING FILE										OPERATED BY BATTLE MEMORIAL ASSOCIATE RIVER OUTFALL DRAIN FIRST FLOOR AREA 1 PLAN									
REFERENCE DRAWINGS NEXT USED ON										REVISIONS CADDNO 30-15H.ACD2-13.C.55 : CADDLE C307793A									
4-3-30780: RIVER OUTFALL AREA 4 PLAN 4-3-307739 RIVER OUTFALL AREA 2 PLAN 4-3-307794 GEN. TITLE SHEET & DRAWING LIST DRAWING NO. DRAWING FILE										OPERATED BY BATTLE MEMORIAL ASSOCIATE RIVER OUTFALL DRAIN FIRST FLOOR AREA 1 PLAN									
REFERENCE DRAWINGS NEXT USED ON										REVISIONS CADDNO 30-15H.ACD2-13.C.55 : CADDLE C307793A

AREA 1 PLAN
SCALE: 1/8" = 1'-0"

3 DETAIL
SCALE: NONE

4 DETAIL
SCALE: NONE

AREA 1 PLAN

SCALE: 1/8" = 1'-0"

6 DETAIL
SCALE: NONE

7 DETAIL
SCALE: NONE

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794.

THIRD FLOOR

KEY PLAN
SCALE: NONE

DOO'63-ESP0192

DRAWN BY RP HUNTER DATE 10-15-78		U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
CHECKED BY J. CASTONCE DATE 10-15-78		RIVER OUTFALL DRAIN THIRD FLOOR AREA 1 PLAN	
APPROVED FOR CONSTRUCTION BY DATE		FACILITY EFFLUENT MONITORING PLAN 331 H-3-307798 0	

REV	DATE	DESCRIPTION
1	10-15-78	AREA 1 PLAN

AREA 2 PLAN
SCALE : 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

TO AREA 1
SEE H-3-307798 SH 1

FIRST FLOOR

KEY PLAN

SCALE: NONE

H-3-307803 SH 2

NO.	DESCRIPTION
H-3-307803	RIVER OUTFALL FIRST FLOOR DETAILS
H-3-307802	RIVER OUTFALL AREA 6 PLAN
H-3-307798	RIVER OUTFALL AREA 1 PLAN
H-3-307794	GEN. TITLE SHEET & DRAWING LIST

PR	BY	DATE	CHK	DATE	REV	DATE

REVISIONS

CHARGE JD.BM:ACD2 13.0 SS

CADFILE C307799A

DESIGNED BY R.P. HUNTER	DATE 10/18/78
DRAWN BY J.L. GASTON	DATE 10/18/78
CHECKED BY M. BROWN	DATE 10/18/78
OTHER	

U. S. DEPARTMENT OF ENERGY RICHLAND OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
RIVER OUTFALL DRAIN FIRST FLOOR AREA 2 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
NO. 2510 331	H-3-307799 0
SCALE SHOWN	SHEET 1 OF 3

AREA 2 PLAN
SCALE : 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

3 DETAIL
SCALE: NONE

SECOND FLOOR
KEY PLAN
SCALE NONE

DRAWING NO.		DRAWING TITLE		REV		DATE		DESCRIPTION	
REFERENCE DRAWINGS		REVISIONS		DATE		DESCRIPTION		DATE	
H-3-307794		RIVER OUTFALL DRAIN		10-15-78		W.E.		10-15-78	
H-3-307794		SECOND FLOOR		10-15-78		W.E.		10-15-78	
H-3-307794		AREA 2 PLAN & DETAILS		10-15-78		W.E.		10-15-78	
H-3-307794		FACILITY EFFLUENT MONITORING PLAN		10-15-78		W.E.		10-15-78	
H-3-307794		RIVER OUTFALL DRAIN		10-15-78		W.E.		10-15-78	
H-3-307794		SECOND FLOOR		10-15-78		W.E.		10-15-78	
H-3-307794		AREA 2 PLAN & DETAILS		10-15-78		W.E.		10-15-78	
H-3-307794		FACILITY EFFLUENT MONITORING PLAN		10-15-78		W.E.		10-15-78	

U. S. DEPARTMENT OF ENERGY
RICHLAND OPERATIONS OFFICE
PACIFIC NORTHWEST NATIONAL LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE
RIVER OUTFALL DRAIN
SECOND FLOOR
AREA 2 PLAN & DETAILS
FACILITY EFFLUENT MONITORING PLAN
REV NO 0
H-3-307794

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

4 DETAIL
- SCALE NONE

TH PD FLOOR

KEY PLAN
SCALE: NONE

DRAWING NO.		DRAWING TITLE		RIVER OUTFALL DRAIN THIRD FLOOR AREA 2 PLAN & DETAILS	
REFERENCE DRAWINGS		REVISIONS CARCODE JD:BM.ACD2 1.0.55 CARCODE C3077992		FACILITY EFFLUENT MONITORING PLAN H-3-307799 0	
NEXT USED ON				31010 331 9900

AREA 3 PLAN
SCALE: 1/8" = 1'-0"

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

SCALE- NONE

OPERATED BY BATTELLE MEMORIAL INSTITUTE RIVER OUTFALL DRAIN FIRST FLOOR AREA 3 PLAN									
FACILITY EFFLUENT MONITORING PLAN DATE: 12/1/80 BY: JMB CHECKED: JMB APPROVED: JMB									
H-3-307800 RIVER OUTFALL AREA 4 PLAN GEN TITLE SHEET & DRAWING SET DRAWING NO.									
REVISIONS NO. DATE DESCRIPTION 1 12/1/80									
REFERENCE DRAWINGS H-3-307794 GEN TITLE SHEET & DRAWING SET DRAWING NO.									
NEXT USED ON: 8510 331 H-3-307800

ROOF

ROOF

MATCH LINE SEE H-3-307801 SH 2

AREA 3 PLAN
SCALE : 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

SECOND FLOOR
KEY PLAN
SCALE: NONE

REV 1 000153-EDPD1P2

DRAWN BE BUTCHER		DATE 10-15-78	
CHECKED J. P. [Signature]		DATE 10-15-78	
DESIGNED J. L. CASTON		DATE 10-15-78	
OTHER [Signature]		DATE 10-15-78	
U. S. DEPARTMENT OF ENERGY RICHLAND OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE			
RIVER OUTFALL DRAIN SECOND FLOOR AREA 3 PLAN			
FACILITY EFFLUENT MONITORING PLAN			
SCALE 3510	331	H-3-30780010	
F 8900		SCALE SHOWN	
NEXT USED ON		SHEET 2 OF 2	

REV	UP	DA	DATE	CHG	DATE	REV	DATE	DESCRIPTION
1								
2								
3								
4								
5								
6								
7								

CADCODE 3D 6M ACD2 13 0:55 CADFILE C3078008

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794.

FIRST FLOOR

KEY PLAN

SCALE: NONE

REFERENCE DRAWINGS	REVISIONS
H-3-307803 RIVER OUTFALL FIRST FLOOR DETAILS	
H-3-307802 RIVER OUTFALL AREA 4 PLAN	
H-3-307800 RIVER OUTFALL AREA 3 PLAN	
H-3-307798 RIVER OUTFALL AREA 1 PLAN	
H-3-307794 GEN TITLE SHEET & DRAWING LIST	

DATE	BY	CHK	REV	DATE	DATE	DATE	DATE	DATE	DATE

U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
RIVER OUTFALL DRAIN FIRST FLOOR AREA 4 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
REV 1	REV 2
8510	8510
8920	8920
H-3-307801/0

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS
SEE DRAWING M-3-307794.

3 AHU #2 DETAIL
- SCALE: NONE

10-15-78

SECOND FLOOR
KEY PLAN
SCALE: NONE

[illegible]

NAME BO BUTCHER	DATE 7/26/80	U. S. DEPARTMENT OF ENERGY RESEARCH OPERATIONS OFFICE	
ADDRESS 1000 1st Avenue S.E. 1000	PHONE 766-1100	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
CITY RICHLAND	STATE WA	RIVER OUTFALL DRAIN	
COUNTY CLATSOP	ZIP 99354	SECOND FLOOR	
NAME J. L. GASTON	DATE 7/26/80	AREA 4 PLAN & DETAILS	
ADDRESS 1000 1st Avenue S.E. 1000	PHONE 766-1100	FACILITY EFFLUENT MONITORING PLAN	
CITY RICHLAND	STATE WA	PROJECT NO. 331	
COUNTY CLATSOP	ZIP 99354	H-3-307801 0	
APPROVED FOR REPLICATION BY W. L. GASTON		SCALE 5"=10' H	
FOR W. L. GASTON		SHEET 2 OF 3

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING M-3-307794.

DETAIL
SCALE: NONE

DETAIL
SCALE: NONE

7 DETAIL
- SCALE: NONE

THIRD FLOOR

KEY PLAN
SCALE: NONE

RECEIVED
D-1548
DATE

W 1 000153-EDP01R2

NAME RP HUNTER	DATE 1/21/70	U. S. DEPARTMENT OF ENERGY 2C-LAND OPERATIONS OFFICE
SIGNATURE [Signature]	TIME 1:10 PM	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTTELLE MEMORIAL INSTITUTE
DATE 1/21/70	TIME 1:10 PM	RIVER OUTFALL DRAIN
LOCATION IL CASTON	TIME 1:10 PM	THIRD FLOOR
DATE 1/21/70	TIME 1:10 PM	AREA 4 PLAN & DETAILS
DATE 1/21/70	TIME 1:10 PM	FACILITY EFFLUENT MONITORING PLAN
DATE 1/21/70	TIME 1:10 PM	NO. 331 H-3-3078010

AREA 5 PLAN
SCALE: 1/8" = 1'-0"

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794

FIRST FLOOR
KEY PLAN
SCALE: NONE

M-3-307501	RIVER OUTFALL AREA 4 PLAN
M-3-307799	RIVER OUTFALL AREA 2 PLAN
M-3-307794	GEN TITLE SHEET & DRAWING LIST
DRAWING NO	DRAWING TITLE
REFERENCE DRAWINGS	
NEXT USED ON	

REV	DATE	BY	DATE	BY	DATE	BY	DATE	DESCRIPTION
REVISIONS								
CAGECODE	3D-BUACD2:13-55						CAGE CODE	01074209A

REPORT BY P. HUNTER	DATE 12/23/73	U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE
CHARGE 1-20-74	CHARGE 1-20-74	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE
APPROVED J. L. GASTON	DATE 1/2/74	RIVER OUTFALL DRAIN
DESCRIPTION J. L. GASTON	DATE 1/2/74	FIRST FLOOR
OTHER J. L. GASTON	DATE 1/2/74	AREA 5 PLAN
CALCULATED BY J. L. GASTON	DATE 1/2/74	FACILITY EFFLUENT MONITORING PLAN
REVIEWED BY J. L. GASTON	DATE 1/2/74	REVISIONS 3310 3500
FILED J. L. GASTON	DATE 1/2/74	FILE NO. H-3-307802

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING 4-3-307794.

THIRD FLOOR

KEY PLAN

SCALE: NONE

EDP / 000163-EDP01R2

DRAWN RP HUNTER		U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE	
CHECKED J. J. [Signature]		PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
DATE 10/15/77		RIVER OUTFALL DRAIN THIRD FLOOR AREA 5 PLAN	
BY J. GASTON		FACILITY EFFLUENT MONITORING PLAN	
DATE 10/15/77		SIZE: 3510 331 H-3-307802	
APPROVED FOR REPLICATION BY J. GASTON		SCALE SHOWN: 1" = 3'	
FOR REVIEW DATE 10/15/77		SHEET 3 OF 3	

DRAWING NO.	DRAWING TITLE	REV.	DATE	BY	DATE	DESCRIPTION
30 H-3-307802	RIVER OUTFALL DRAIN THIRD FLOOR AREA 5 PLAN	1	10/15/77	J. GASTON		
REFERENCE DRAWINGS		REVISIONS				
NEXT USED ON		CADD CODE 30 H-3-307802				

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

1 PIT DETAIL
H-3-307799 SH 1 SCALE: 1/8" 1'-0"

EXP # D00163-EDP01R2

U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
RIVER OUTFALL DRAIN FIRST FLOOR DETAILS	
FACILITY EFFLUENT MONITORING PLAN	
REV NO F	REV NO 331
REV NO 8510	REV NO 8900
H-3-307803 0	
SCALE SHOWN	
SHEET 1 OF 2	

H-3-307795	SITE PLAN
H-3-307801	RIVER OUTFALL AREA 4 PLAN
H-3-307799	RIVER OUTFALL AREA 2 PLAN
H-3-307798	RIVER OUTFALL AREA 1 PLAN
H-3-307794	GEN TITLE SHEET & DRAWING LIST
DRAWING NO	DRAWING TITLE
REFERENCE DRAWINGS	
NEXT USED ON	

REV	NO	DATE	DESCRIPTION
1	1	10/13/80	ISSUED FOR CONSTRUCTION
2	2	10/13/80	ISSUED FOR CONSTRUCTION
3	3	10/13/80	ISSUED FOR CONSTRUCTION
4	4	10/13/80	ISSUED FOR CONSTRUCTION
5	5	10/13/80	ISSUED FOR CONSTRUCTION
6	6	10/13/80	ISSUED FOR CONSTRUCTION
7	7	10/13/80	ISSUED FOR CONSTRUCTION
8	8	10/13/80	ISSUED FOR CONSTRUCTION
9	9	10/13/80	ISSUED FOR CONSTRUCTION
10	10	10/13/80	ISSUED FOR CONSTRUCTION

PROJECT 30-10M-ACD2-13.0-SS

OFFICE C307813A

2 DETAIL FISH TANK AREA ENLARGED PLAN
 H-3-307799 SH 1 SCALE: 1/8"=1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS.
SEE DRAWING H-3-307794.

① MECH RM 118 DETAIL
H-3-307801 SH 1 SCALE: 1/8" = 1'-0"

ED 1 DOC:63-EDPC1P2

DRAWN BE BUTCHER		DATE 12/22/71	
CHECKED J. L. GASTON		DATE 12/22/71	
APPROVED J. L. GASTON		DATE 12/22/71	
U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE			
RIVER OUTFALL DRAIN FIRST FLOOR DETAILS			
FACILITY EFFLUENT MONITORING PLAN			
REV. 12 10-15-71		REV. 12 10-15-71	
H-3-307801		H-3-307803	

DATE	BY	CHKD	APPD	DESCRIPTION
12/22/71	BE BUTCHER	J. L. GASTON	J. L. GASTON	MECH RM 118 DETAIL

REVISIONS

DRAWING NO.	DRAWING TITLE
H-3-307802	SANITARY DRAIN AREA 4 PLAN
H-3-307805	SANITARY DRAIN AREA 1 PLAN
H-3-307794	GEN TITLE SHEET & DRAWING LIST

REV	DATE	BY	CHK	REV	DATE	DESCRIPTION
1	10/1/78	W. H. H. H.	W. H. H. H.	1	10/1/78	W. H. H. H.
2	10/1/78	W. H. H. H.	W. H. H. H.	2	10/1/78	W. H. H. H.
3	10/1/78	W. H. H. H.	W. H. H. H.	3	10/1/78	W. H. H. H.
4	10/1/78	W. H. H. H.	W. H. H. H.	4	10/1/78	W. H. H. H.
5	10/1/78	W. H. H. H.	W. H. H. H.	5	10/1/78	W. H. H. H.
6	10/1/78	W. H. H. H.	W. H. H. H.	6	10/1/78	W. H. H. H.
7	10/1/78	W. H. H. H.	W. H. H. H.	7	10/1/78	W. H. H. H.
8	10/1/78	W. H. H. H.	W. H. H. H.	8	10/1/78	W. H. H. H.
9	10/1/78	W. H. H. H.	W. H. H. H.	9	10/1/78	W. H. H. H.
10	10/1/78	W. H. H. H.	W. H. H. H.	10	10/1/78	W. H. H. H.

U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
SANITARY DRAIN FIRST FLOOR AREA 1 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
DATE: 10/1/78	REV: 10
BY: W. H. H. H.	CHK: W. H. H. H.
APPROVED FOR: W. H. H. H.	DATE: 10/1/78
H-3-307804 0

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794.

SECOND FLOOR
KEY PLAN
SCALE: NONE

CD 1 000163-ESPO'P'

U. S. DEPARTMENT OF ENERGY BOWLING OPERATIONS OFFICE	
PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
SANITARY DRAIN SECOND FLOOR AREA 1 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
DATE: 10/13/88 BY: J. GASTON	SCALE: SHOWN
NO. 331 H-3-307804	INLET 2 OF 3

REV	DATE	BY	CHK	REV	DATE	DESCRIPTION
1	10/13/88	J. GASTON				
2	10/13/88	J. GASTON				
3	10/13/88	J. GASTON				
4	10/13/88	J. GASTON				
5	10/13/88	J. GASTON				
6	10/13/88	J. GASTON				
7	10/13/88	J. GASTON				
8	10/13/88	J. GASTON				
9	10/13/88	J. GASTON				
10	10/13/88	J. GASTON				
11	10/13/88	J. GASTON				
12	10/13/88	J. GASTON				
13	10/13/88	J. GASTON				
14	10/13/88	J. GASTON				
15	10/13/88	J. GASTON				
16	10/13/88	J. GASTON				
17	10/13/88	J. GASTON				
18	10/13/88	J. GASTON				
19	10/13/88	J. GASTON				
20	10/13/88	J. GASTON				
21	10/13/88	J. GASTON				
22	10/13/88	J. GASTON				
23	10/13/88	J. GASTON				
24	10/13/88	J. GASTON				
25	10/13/88	J. GASTON				
26	10/13/88	J. GASTON				
27	10/13/88	J. GASTON				
28	10/13/88	J. GASTON				
29	10/13/88	J. GASTON				
30	10/13/88	J. GASTON				
31	10/13/88	J. GASTON

AREA 1 PLAN
SCALE: 1/8" = 1'-0"

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

COPIES DGC0163-ED-0002

U. S. DEPARTMENT OF ENERGY
HIGHLAND OPERATIONS OFFICE

PACIFIC NORTHWEST NATIONAL LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE

SANITARY DRAIN

SANITARY DRAIN
THIRD FLOOR
AREA 1 PLAN

FACILITY EFFLUENT MONITORING PLAN

54C8 331 H-3-307804 0

NAME RD MUNIER	DATE 1/1/19
ADDRESS 1111 1/2 St	TIME 11:00
PHONE 1111 1/2 St	TIME 11:00
NAME A. GASTON	DATE 1/1/19
ADDRESS 1111 1/2 St	TIME 11:00
PHONE 1111 1/2 St	TIME 11:00
NAME A. GASTON	DATE 1/1/19
ADDRESS 1111 1/2 St	TIME 11:00
PHONE 1111 1/2 St	TIME 11:00

PR	MR	GR BY	ENGR BY	CHE BY	REV BY	DESCRIPTION
		DATE	DATE	DATE	DATE	
REVISIONS

AREA 2 PLAN
SCALE: 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS.
SEE DRAWING H-3-307794.

FIRST FLOOR

KEY PLAN

SCALE: NONE

CD 1 000153-EDP01P2

NAME RF HUNTER		DATE ENR		U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE	
PROJECT PACIFIC NORTHWEST NATIONAL LABORATORY		OPERATED BY BATTELLE MEMORIAL INSTITUTE		PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
DRAWN JL CASTON		CHECKED JL CASTON		SANITARY DRAIN FIRST FLOOR AREA 2 PLAN	
FACILITY EFFLUENT MONITORING PLAN		SHEET NO. 3408		H-3-30780510	
SCALE AS SHOWN		SHEET 1 OF 3		10-15-78	

DRAWING NO.	DRAWING TITLE	REV.	DATE	BY	CHK.	DATE	DESCRIPTION
H-3-307807	SANITARY DRAIN AREA 5 PLAN						
H-3-307804	SANITARY DRAIN AREA 1 PLAN						
H-3-307794	GEN. TITLE SHEET & DRAWING LIST						
REVISIONS							
REFERENCE DRAWINGS							
NEXT USED ON							
CADD CODE 20-BW AC02.13 0.55				CADD CODE C307805A

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

2 DETAIL
- SCALE: NONE

THIRD FLOOR

KEY PLAN
SCALE: NONE

REF ID: A660153

SANITARY DRAIN
THIRD FLOOR
AREA 2 PLAN

FACILITY EFFLUENT MONITORING PLAN

FILE NO	INDEX NO	DATE NO	FILE NO
8510	E403	331	H-3-307805
			0

[illegible]

AREA 4 PLAN
SCALE: 1/8" = 1'-0"

A SECTION
SCALE: NONE

AREA 4 PLAN
SCALE : 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

SECOND FLOOR
KEY PLAN
SCALE: NONE

CDP / DOC163-EDP01R2

DRAWN RD MUMTER		DATE 12/8/78	U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE	
CHECKED J. J. GASTON		DATE 1/1/79	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
DESIGNED J. J. GASTON		DATE 1/1/79	SANITARY DRAIN SECOND FLOOR AREA 4 PLAN	
APPROVED FOR CONSTRUCTION J. J. GASTON		DATE 1/1/79	FACILITY EFFLUENT MONITORING PLAN	
PROJECT NO. 8408		SHEET NO. 331	DRAWING NO. H-3-307806	

REV	DATE	BY	CHK	DATE	DESCRIPTION

REFERENCE DRAWINGS

REVISIONS

AREA 5 PI
SCALE: 1/8" = 1'

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING W-3-307794.

KEY PLAN
SCALE: NONE

TITLE	RP HUNTER	DATE	7/9/78	U. S. DEPARTMENT OF ENERGY - WILMINGTON OPERATIONS OFFICE					
DRAWN BY	R.P.Z.	CHECKED BY	[Signature]	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE					
SPECIAL NOTES	[Handwritten notes]	SCALE	AS SHOWN	SANITARY DRAIN					
DESIGNED BY	H. CASTON	APPROVED BY	[Signature]	FIRST FLOOR					
DATE	7/10/78	PROJECT NO.	94-04	AREA 5 PLAN					
BY	Vincent Nguyen	CHECKED BY	[Signature]	FACILITY EFFLUENT MONITORING PLAN					
REVISIONS	FOR INFORMATION [Handwritten note]	NO.	1	DATE	8/28/78	REVISED BY	J.S.I.	REV. NO.	1
DESCRIPTION	E	NO.	851C	ID	331	PLAN NO.	H-3-307807	REV. NO.	0

AREA 5 PLAN

SCALE : 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

SECOND FLOOR
KEY PLAN
SCALE: NONE

DP 1 000163-EDPG1R2

U. S. DEPARTMENT OF ENERGY RICHLAND OPERATIONS OFFICE	
PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
SANITARY DRAIN SECOND FLOOR AREA 5 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
DATE: 10/10/81 BY: J. GASTON, F.H.L. CHECKED: J. GASTON, F.H.L. APPROVED: J. GASTON, F.H.L.	PROJECT NO: 3403 DRAWING NO: 8510 SHEET NO: 331 H-3-307807 REV NO: 0

REV	DATE	DESCRIPTION
1	10/10/81	10/10/81
2	10/10/81	10/10/81
3	10/10/81	10/10/81
4	10/10/81	10/10/81
5	10/10/81	10/10/81
6	10/10/81	10/10/81
7	10/10/81	10/10/81
8	10/10/81	10/10/81
9	10/10/81	10/10/81
10	10/10/81	10/10/81

REV	DATE	DESCRIPTION
1	10/10/81	10/10/81
2	10/10/81	10/10/81
3	10/10/81	10/10/81
4	10/10/81	10/10/81
5	10/10/81	10/10/81
6	10/10/81	10/10/81
7	10/10/81	10/10/81
8	10/10/81	10/10/81
9	10/10/81	10/10/81
10	10/10/81	10/10/81

AREA 5 PLAN
SCALE : 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794.

THIRD FLOOR

KEY PLAN
SCALE: NONE

EXP 1 D00:63-EC01R2

U. S. DEPARTMENT OF ENERGY RESEARCH OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
SANITARY DRAIN THIRD FLOOR AREA 5 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
DATE: 10-15-77 BY: J. L. GASTON CHECKED: J. L. GASTON APPROVED: J. L. GASTON	DATE: 10-15-77 BY: J. L. GASTON CHECKED: J. L. GASTON APPROVED: J. L. GASTON
8408 331	H-3-307807 10

DATE	BY	CHK	REV	DESCRIPTION
10-15-77	J. L. GASTON	J. L. GASTON	1	THIRD FLOOR
REVISIONS				
REFERENCE DRAWINGS				
NEXT REVISION

NAME SP HUNTER	DATE 12/1/78	U. S. DEPARTMENT OF ENERGY ROMANA OPERATIONS OFFICE	
NAME P. P. L...	DATE 12/1/78	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
NAME J. L. GASTON	DATE 12/1/78	SANITARY DRAIN SECOND FLOOR DETAILS	
NAME J. M. B...	DATE 12/1/78	FACILITY EFFLUENT MONITORING PLAN	
NAME A. R. Q...	DATE 12/1/78	MODEL NO. 5408	REV NO. 331
NAME C. R. F...	DATE 12/1/78	MODEL NO. 5510	REV NO. H-3-307808

AREA 1 PLAN
SCALE: 1/8" = 1'-0"

① DETAIL
SCALE: NONE

② DET
SCALE:

						DESIGNED BY SATELLE DESIGN ASSOCIATES PROCESS DRAIN FIRST FLOOR AREA 1 PLAN							
						CHECKED BY GASTON J. C. J. DATE 7/9/79							
						DRAWN BY [Signature] DATE 7/9/79							
NO.	DATE	BY	REVISIONS	DESCRIPTION									
H-3-307812				PROCESS DRAIN AREA 1 PLAN									
H-3-307810				PROCESS DRAIN AREA 2 PLAN									
H-3-307794				GEN TYLE SH & DRAWING - ST									
REFERENCE DRAWINGS													
REVISIONS													
NO. DATE BY REVISIONS DESCRIPTION H-3-307810 7/9/79 [Signature] PROCESS DRAIN AREA 2 PLAN H-3-307794 7/9/79 [Signature] GEN TYLE SH & DRAWING - ST													

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794

7 DETAIL
SCALE: NONE

6 DETAIL
SCALE: NONE

SECOND FLOOR
KEY PLAN
SCALE: NONE

U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
PROCESS DRAIN SECOND FLOOR AREA 1	
FACILITY EFFLUENT MONITORING PLAN	
DATE: 10/1/80 BY: J. CASTON	REV: 1 DATE: 10/1/80
H-3-307809 0	

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794

THIRD FLOOR

KEY PLAN
SCALE: NONE

U. S. DEPARTMENT OF ENERGY

PACIFIC NORTHWEST NATIONAL LABORATORY
OPERATED BY BATTELLE MEMORIAL INSTITUTE

PROCESS DRAIN
THIRD FLOOR
AREA 1

FACILITY EFFLUENT MONITORING PLAN

DATE	BY	DESCRIPTION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION
10/15/78	RD HUNTER	REVISION

H-3-307809 0

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794.

4 DETAIL
SCALE: NONE

5 DETAIL
SCALE: NONE
NOTE: DETAIL LOOKING NORTH

6 DETAIL
SCALE: NONE
NOTE: DETAIL LOOKING NORTH

DETAIL
SCALE: NONE

KEY PLAN
SCALE: NONE

REF. NO.	DATE	DESCRIPTION
H-3-307795	10/15/98	PROCESS DRAIN AREA 5 PLAN
H-3-307801	10/15/98	PROCESS DRAIN AREA 5 PLAN
H-3-307809	10/15/98	PROCESS DRAIN AREA 1 PLAN
H-3-307794	10/15/98	GEN. TITLE SHEET & DRAWING LIST

REV.	DATE	DESCRIPTION
1	10/15/98	PROCESS DRAIN AREA 1 PLAN
2	10/15/98	PROCESS DRAIN AREA 1 PLAN
3	10/15/98	PROCESS DRAIN AREA 1 PLAN
4	10/15/98	PROCESS DRAIN AREA 1 PLAN
5	10/15/98	PROCESS DRAIN AREA 1 PLAN
6	10/15/98	PROCESS DRAIN AREA 1 PLAN
7	10/15/98	PROCESS DRAIN AREA 1 PLAN
8	10/15/98	PROCESS DRAIN AREA 1 PLAN
9	10/15/98	PROCESS DRAIN AREA 1 PLAN
10	10/15/98	PROCESS DRAIN AREA 1 PLAN

U. S. DEPARTMENT OF ENERGY SCIENCE OPERATIONS OFFICE	
PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTTEL MEMORIAL INSTITUTE	
PROCESS DRAIN FIRST FLOOR AREA 2 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
DATE: 10/15/98	REV. NO: 1
BY: J. L. GASTON	APP. FOR: J. L. GASTON
DATE: 10/15/98	DATE: 10/15/98
NO. 1000:63-EDP01R2	H-3-30781010

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS,
SEE DRAWING H-3-307794

11 DETAIL
SCALE: NONE

10 DETAIL
SCALE: NONE

SECOND FLOOR
KEY PLAN
SCALE: NONE

DRAWN BY SP HUNTER		DATE 1/3/77	U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE	
CHECKED BY J. GASTON		DATE 1/11/77	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
APPROVED FOR CONSTRUCTION J. GASTON		DATE 1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2	
FACILITY EFFLUENT MONITORING PLAN		REV NO 8407	REV NO 331	REV NO H-3-307810
FACILITY EFFLUENT MONITORING PLAN		SCALE 8405	SCALE SHCAN	SHEET 2 OF 3

REV	DATE	BY	CHKD BY	DATE	DESCRIPTION
1	1/3/77	SP HUNTER	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
2	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
3	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
4	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
5	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
6	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
7	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
8	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
9	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2
10	1/11/77	J. GASTON	J. GASTON	1/11/77	PROCESS DRAIN SECOND FLOOR AREA 2

13 12 11 10 9 8

MATCH LINE-SEE H-3-307813 SH 3

MATCH LINE-SEE H-3-307809 SH 3

AREA 2 PLAN
SCALE: 1/8" = 1'-0"

FOR GENERAL NOTES, AND SYMBOLS AND ABBREVIATIONS, SEE DRAWING M-3-307794.

KEY PLAN
SCALE: NONE

DRAWING NO.		DRAWING TITLE		REVISIONS		DESCRIPTION		1. 1/10/94 2. 1/10/94 3. 1/10/94 4. 1/10/94 5. 1/10/94 6. 1/10/94 7. 1/10/94 8. 1/10/94 9. 1/10/94 10. 1/10/94 11. 1/10/94 12. 1/10/94 13. 1/10/94 14. 1/10/94 15. 1/10/94 16. 1/10/94 17. 1/10/94 18. 1/10/94 19. 1/10/94 20. 1/10/94 21. 1/10/94 22. 1/10/94 23. 1/10/94 24. 1/10/94 25. 1/10/94 26. 1/10/94 27. 1/10/94 28. 1/10/94 29. 1/10/94 30. 1/10/94 31. 1/10/94 32. 1/10/94 33. 1/10/94 34. 1/10/94 35. 1/10/94 36. 1/10/94 37. 1/10/94 38. 1/10/94 39. 1/10/94 40. 1/10/94 41. 1/10/94 42. 1/10/94 43. 1/10/94 44. 1/10/94 45. 1/10/94 46. 1/10/94 47. 1/10/94 48. 1/10/94 49. 1/10/94 50. 1/10/94 51. 1/10/94 52. 1/10/94 53. 1/10/94 54. 1/10/94 55. 1/10/94 56. 1/10/94 57. 1/10/94 58. 1/10/94 59. 1/10/94 60. 1/10/94 61. 1/10/94 62. 1/10/94 63. 1/10/94 64. 1/10/94 65. 1/10/94 66. 1/10/94 67. 1/10/94 68. 1/10/94 69. 1/10/94 70. 1/10/94 71. 1/10/94 72. 1/10/94 73. 1/10/94 74. 1/10/94 75. 1/10/94 76. 1/10/94 77. 1/10/94 78. 1/10/94 79. 1/10/94 80. 1/10/94 81. 1/10/94 82. 1/10/94 83. 1/10/94 84. 1/10/94 85. 1/10/94 86. 1/10/94 87. 1/10/94 88. 1/10/94 89. 1/10/94 90. 1/10/94 91. 1/10/94 92. 1/10/94 93. 1/10/94 94. 1/10/94 95. 1/10/94 96. 1/10/94 97. 1/10/94 98. 1/10/94 99. 1/10/94 100. 1/10/94 101. 1/10/94 102. 1/10/94 103. 1/10/94 104. 1/10/94 105. 1/10/94 106. 1/10/94 107. 1/10/94 108. 1/10/94 109. 1/10/94 110. 1/10/94 111. 1/10/94 112. 1/10/94 113. 1/10/94 114. 1/10/94 115. 1/10/94 116. 1/10/94 117. 1/10/94 118. 1/10/94 119. 1/10/94 120. 1/10/94 121. 1/10/94 122. 1/10/94 123. 1/10/94 124. 1/10/94 125. 1/10/94 126. 1/10/94 127. 1/10/94 128. 1/10/94 129. 1/10/94 130. 1/10/94 131. 1/10/94 132. 1/10/94 133. 1/10/94 134. 1/10/94 135. 1/10/94 136. 1/10/94 137. 1/10/94 138. 1/10/94 139. 1/10/94 140. 1/10/94 141. 1/10/94 142. 1/10/94 143. 1/10/94 144. 1/10/94 145. 1/10/94 146. 1/10/94 147. 1/10/94 148. 1/10/94 149. 1/10/94 150. 1/10/94 151. 1/10/94 152. 1/10/94 153. 1/10/94 154. 1/10/94 155. 1/10/94 156. 1/10/94 157. 1/10/94 158. 1/10/94 159. 1/10/94 160. 1/10/94 161. 1/10/94 162. 1/10/94 163. 1/10/94 164. 1/10/94 165. 1/10/94 166. 1/10/94 167. 1/10/94 168. 1/10/94 169. 1/10/94 170. 1/10/94 171. 1/10/94 172. 1/10/94 173. 1/10/94 174. 1/10/94 175. 1/10/94 176. 1/10/94 177. 1/10/94 178. 1/10/94 179. 1/10/94 180. 1/10/94 181. 1/10/94 182. 1/10/94 183. 1/10/94 184. 1/10/94 185. 1/10/94 186. 1/10/94 187. 1/10/94 188. 1/10/94 189. 1/10/94 190. 1/10/94 191. 1/10/94 192. 1/10/94 193. 1/10/94 194. 1/10/94 195. 1/10/94 196. 1/10/94 197. 1/10/94 198. 1/10/94 199. 1/10/94 200. 1/10/94 201. 1/10/94 202. 1/10/94 203. 1/10/94 204. 1/10/94 205. 1/10/94 206. 1/10/94 207. 1/10/94 208. 1/10/94 209. 1/10/94 210. 1/10/94 211. 1/10/94 212. 1/10/94 213. 1/10/94 214. 1/10/94 215. 1/10/94 216. 1/10/94 217. 1/10/94 218. 1/10/94 219. 1/10/94 220. 1/10/94 221. 1/10/94 222. 1/10/94 223. 1/10/94 224. 1/10/94 225. 1/10/94 226. 1/10/94 227. 1/10/94 228. 1/10/94 229. 1/10/94 230. 1/10/94 231. 1/10/94 232. 1/10/94 233. 1/10/94 234. 1/10/94 235. 1/10/94 236. 1/10/94 237. 1/10/94 238. 1/10/94 239. 1/10/94 240. 1/10/94 241. 1/10/94 242. 1/10/94 243. 1/10/94 244. 1/10/	
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MATCH LINE-H-3-307812 SH 1

AREA 3 PLAN
SCALE: 1/8" = 1'-0"

5 DETAIL
SCALE: NONE

6 DETAIL
SCALE: NONE

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794

5 DETAIL
SCALE: NONE

6 DETAIL
SCALE: NONE

A SECTION
SCALE: NONE

4 DETAIL
SCALE: NONE

7 DETAIL
SCALE: NONE

KEY PLAN
SCALE: NONE

DRAWING NO.	DRAWING TITLE
H-3-307813	PROCESS DRAIN AREA 5 PLAN
H-3-307811	PROCESS DRAIN AREA 3 PLAN
H-3-307809	PROCESS DRAIN AREA 1 PLAN
H-3-307794	2ND FLOOR SHEET & DRAINING LIST

REV.	DATE	BY	CHKD.	DATE	DESCRIPTION
1	10/15/77	JL	RR	10/15/77	10-15-77

REV.	DATE	BY	CHKD.	DATE	DESCRIPTION
1	10/15/77	JL	RR	10/15/77	10-15-77

U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTelle MEMORIAL INSTITUTE	
PROCESS DRAIN FIRST FLOOR AREA 4 PLAN	
FACILITY EFFLUENT MONITORING PLAN	
DATE: 10/15/77	SCALE: SHOWN
BY: J. L. GASTON	10-15-77

MATCH LINE-SEE H-3-307813 SH 2

AREA 4 PLAN
SCALE: 1/8" = 1'-0"

8 DETAIL
SCALE: NONE

9 DETAIL
SCALE: NONE

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE
DRAWING G H-3-367794.

SECOND FLOOR
KEY PLAN
SCALE: NONE

REF: D00153-EC00002

DRAWN RP HUNTER		DATE 10/16/78	U. S. DEPARTMENT OF ENERGY NORTHWEST OPERATIONS OFFICE	
CHECKED JL GASTON		DATE 10/16/78	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
APPROVED JL GASTON		DATE 10/16/78	PROCESS DRAIN SECOND FLOOR AREA 4	
DRAWN V. H. D. D. D.		DATE 10/16/78	FACILITY EFFLUENT MONITORING PLAN	
APPROVED FOR IMPLEMENTATION JL GASTON		DATE 10/16/78	SCALE: SHOWN	
DRAWN JL GASTON		DATE 10/16/78	SHEET 2 OF 3	

DRAWING NO.	DRAWING TITLE	REV.	DATE	DESCRIPTION
1	PROCESS DRAIN SECOND FLOOR AREA 4	1	10/16/78	INITIAL DESIGN
2	PROCESS DRAIN SECOND FLOOR AREA 4	2	10/16/78	REVISED FOR IMPLEMENTATION
3	PROCESS DRAIN SECOND FLOOR AREA 4	3	10/16/78	REVISED FOR IMPLEMENTATION
4	PROCESS DRAIN SECOND FLOOR AREA 4	4	10/16/78	REVISED FOR IMPLEMENTATION
5	PROCESS DRAIN SECOND FLOOR AREA 4	5	10/16/78	REVISED FOR IMPLEMENTATION
6	PROCESS DRAIN SECOND FLOOR AREA 4	6	10/16/78	REVISED FOR IMPLEMENTATION
7	PROCESS DRAIN SECOND FLOOR AREA 4	7	10/16/78	REVISED FOR IMPLEMENTATION
8	PROCESS DRAIN SECOND FLOOR AREA 4	8	10/16/78	REVISED FOR IMPLEMENTATION
9	PROCESS DRAIN SECOND FLOOR AREA 4	9	10/16/78	REVISED FOR IMPLEMENTATION
10	PROCESS DRAIN SECOND FLOOR AREA 4	10	10/16/78	REVISED FOR IMPLEMENTATION

AREA 4 PLAN
SCALE: 1/8" = 1'-0"

10 DETAIL
SCALE: NONE

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794.

THIRD FLOOR

KEY PLAN
SCALE: NONE

DOE/DOO/63-EGPC/12

U. S. DEPARTMENT OF ENERGY RICHLAND OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
PROCESS DRAIN THIRD FLOOR AREA 4	
FACILITY EFFLUENT MONITORING PLAN	
DRAWN BY: SP HUNTER DATE: 3/89	CHECKED BY: J. GASTON DATE: 10/15/95
REVISIONS 1. WANN, M. 10/15/95 2. WANN, M. 10/15/95 3. WANN, M. 10/15/95	SCALE: NONE SHEET NO. 331 DRAWING NO. H-3-307812-10 SHEET 3 OF 3

DATE	BY	DESCRIPTION
10/15/95	WANN, M.	1. WANN, M. 10/15/95
10/15/95	WANN, M.	2. WANN, M. 10/15/95
10/15/95	WANN, M.	3. WANN, M. 10/15/95

DRAWING NO. DRAWING TITLE NEXT USED ON	REFERENCE DRAWINGS 30.5M ACD2-13.055 30.5M ACD2-13.055	REVISIONS 1. WANN, M. 10/15/95 2. WANN, M. 10/15/95 3. WANN, M. 10/15/95
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NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794.

KEY PLAN
SCALE: NONE

H-3-307812 PROCESS DRAIN AREA 4 PLAN		H-3-307810 PROCESS DRAIN AREA 2 PLAN		H-3-307794 GEN TITLE SHEET & DRAWING LIST	
DRAWING NO. DRAWING TITLE					
REFERENCE DRAWINGS					
NEXT USED ON					
REVISIONS					
NO.	DATE	BY	CHK BY	DATE	DESCRIPTION
1	10-5-78	DATE			
U. S. DEPARTMENT OF ENERGY RICHMOND OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE					
PROCESS DRAIN FIRST FLOOR AREA 5 PLAN					
FACILITY EFFLUENT MONITORING PLAN					
APPROVED FOR VALIDATION BY: [Signature] DATE: 10-5-78					
F 8407 331 H-3-307813.10 8408 SCALE SHOWN SHEET 3

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE DRAWING H-3-307794.

-307812 SH 2

LINE REMOVED ABOVE
ON 3RD FLOOR

SECOND FLOOR
KEY PLAN
SCALE: NONE

ED 1 000163-ED01P2

U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
PROCESS DRAIN SECOND FLOOR AREA 5	
FACILITY EFFLUENT MONITORING PLAN	
DRAWN BY: HUNTER DATE: 10-15-78 CHECKED BY: J. GASTON DATE: 10-15-78 APPROVED BY: [Signature] DATE: 10-15-78	MAY 1979 SHEET NO. 331 BLOCK NO. 8407 SCALE: SHOWN H-3-307813 SHEET 2 OF 3

REVISIONS	DATE	BY	DESCRIPTION
1	10-15-78	HUNTER	INITIAL DESIGN
2	10-15-78	J. GASTON	REVISIONS
3	10-15-78	[Signature]	APPROVED

AREA 5 PLAN

SCALE: 1/8" = 1'-0"

NOTE

FOR GENERAL NOTES, SYMBOLS AND ABBREVIATIONS, SEE H-3-307794.

THIRD FLOOR

KEY PLAN
SCALE: NONE

EDP 1 000153-EDP01P2

DRAWN RP HUNTER DATE 1/7/78		U. S. DEPARTMENT OF ENERGY ROCKWELL OPERATIONS OFFICE PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE	
CHECKED J. F. Z... DATE 3/3/78		PROCESS DRAIN THIRD FLOOR AREA 5	
DESIGNED J. L. GASTON DATE 1/7/78		FACILITY EFFLUENT MONITORING PLAN	
OTHER DATE 1/7/78		SCALE: NONE SHEET NO. 331 H-3-307813-0 DATE SHOWN 1987 3 3	

DRAWING NO.		DRAWING TITLE		REVISIONS		LOCATION	
PR	AP	JA	DAOR	DR	REV	DATE	DATE
REFERENCE DRAWINGS				NEXT USED ON			
JACOBI 3D IBM ACD2 13.0-55				JACOBI C337813

AREA 4 PL/
SCALE : 1/8" = 1'-0"

NOTES

1. FOR GENERAL NOTES, SYMBOLS, AND ABBREVIATIONS, SEE DRAWING H-3-307794.
2. ALL OTHER CONDENSATE IN BUILDING DRAINS TO PROCESS SEWER. SEE PROCESS SEWER DRAIN PLANS FOR CONNECTIONS.

KEY PLAN

SCALE: NONE

H-3-307930 CONDENSATE DRAIN AREA 5 PLAN		DATE 10/11/80		U. S. DEPARTMENT OF ENERGY	
H-3-307794 GEN. TITLE SHEET & DRAWING LIST		DATE 10/11/80		ROCKWELL OPERATIONS OFFICE	
DRAWING NO. 107-11		DATE 10/11/80		PACIFIC NORTHWEST NATIONAL LABORATORY	
DRAWING TITLE		DATE 10/11/80		OPERATED BY BATTILLE MEMORIAL INSTITUTE	
REFERENCE DRAWINGS		DATE 10/11/80		CONDENSATE DRAIN	
NEXT USED ON		DATE 10/11/80		FIRST FLOOR	
CADD CODE 10-HBM-ACC-113 D-SS		DATE 10/11/80		AREA 4 PLAN	
CADD FILE C307929A		DATE 10/11/80		FACILITY EFFLUENT MONITORING PLAN	
REVISIONS		DATE 10/11/80		H-3-30792910	
DATE 10/11/80		DATE 10/11/80		SCALE 5/40"=1"	
DATE 10/11/80		DATE 10/11/80		SHEET 1 OF 1

NOTES

1. FOR GENERAL NOTES, SYMBOLS, AND ABBREVIATIONS, SEE DRAWING H-3-307794.
2. ALL OTHER CONDENSATE IN BUILDING DRAINS TO PROCESS SEWER, SEE PROCESS SEWER DRAIN PLANS FOR CONNECTIONS.

FIRST FLOOR

KEY PLAN

SCALE: NONE

DP 1 000163-EDPS192

DRAWING BY BUTCHER		DATE 10/15/77	U. S. DEPARTMENT OF ENERGY WILKINSON OPERATIONS OFFICE	
CHECKED BY [Signature]		DATE 10/15/77	PACIFIC NORTHWEST NATIONAL LABORATORY OPERATED BY BATTelle MEMORIAL INSTITUTE	
DESIGNED BY [Signature]		DATE 10/15/77	CONDENSATE DRAIN FIRST FLOOR AREA 5 PLAN	
DRAWN BY [Signature]		DATE 10/15/77	FACILITY EFFLUENT MONITORING PLAN	
APPROVED FOR CONSTRUCTION BY [Signature]		DATE 10/15/77	H-3-30793010	
FOR [Signature]		DATE 10/15/77	SCALE SHOWN	

H-3-307929	CONDENSATE DRAIN AREA 4 PLAN	REV	DATE	DESCRIPTION
H-3-307794	GEN TITLE SHEET & DRAWING LIST			
REVISIONS				
1	10.18M ACC 13 0.55			10.18M ACC 13 0.55
2	10.18M ACC 13 0.55			10.18M ACC 13 0.55
3	10.18M ACC 13 0.55			10.18M ACC 13 0.55
4	10.18M ACC 13 0.55			10.18M ACC 13 0.55
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10	10.18M ACC 13 0.55			10.18M ACC 13 0.55
11	10.18M ACC 13 0.55			10.18M ACC 13 0.55
12	10.18M ACC 13 0.55			10.18M ACC 13 0.55
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78	10.18M ACC 13 0.55			10.18M ACC 13 0.55
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90	10.18M ACC 13 0.55			10.18M ACC 13 0.55
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94	10.18M ACC 13 0.55			10.18M ACC 13 0.55
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98	10.18M ACC 13 0.55			10.18M ACC 13 0.55
99	10.18M ACC 13 0.55			10.18M ACC 13 0.55
100	10.18M ACC 13 0.55			10.18M ACC 13 0.55

THIRD FLOOR PLAN
SCALE : NONE

SECOND FLOOR PLAN
SCALE : NONE

FIRST FLOOR PLAN
SCALE : NONE

EXHAUST FLOW DIAGRAM

PREL
RELEASE
01-17-82
DATE

L SW 3RD FL H-3-28165-A 5 MECHANICAL SE 2ND FL VENT										L NW 3RD FL H-3-28164-A 5 MECHANICAL NE 2ND FL VENT										L SE 3RD FL H-3-28162 10 MECHANICAL SW 1ST FL										L NE 3RD FL H-3-28161 6 MECHANICAL NW 1ST FL										L SW 2ND FL VENT H-3-28160 7 MECHANICAL SE 1ST FL										L NW 2ND FL VENT H-3-28159 7 MECHANICAL NE 1ST 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NEXT USED ON										CADD CODE 304BM-ACD2:12.0:55										CADD CODE C070213A										FUND-ECN35										CONDITIONS PER 000163-EDP01R2-SH 5 AND AS BUILT PER AS FOUND WAS SH 1 OF 7. ADDED EOPT LABELS.										PER ECH 9C-164-002										RMDV REVS IN CONTROL BLOCK

FIRST FLOOR PLAN
SCALE : NONE

EXHAUST FLOW DIAGRAM

DRAWING NO. 1 LAMING TITLE NEXT USED ON		REVISIONS CHOCOR 30-24-ACD2:12.0'SS CHOCOR 60702138		REVISIONS DATE DATE DATE DATE DATE DATE BY BY BY BY BY BY BY		DESCRIPTION FMPOO-ECNOS CONDITIONS PER D00163-EDP01R2- SH 8 AND AS BUILT PER AS FOUND WAS SH 2 OF 7. ADDED EOPT LABELS. PER EON 59-164-002 RAYD REVISION CONTROL BLOCK		APPROVED FOR IMPLEMENTATION BY J.W. LEEPER DATE 5/14/92		U. S. DEPARTMENT OF ENERGY REGIONAL OPERATIONS OFFICE PACIFIC NORTHWEST LABORATORY OPERATED BY BATTTELLE MEMORIAL INSTITUTE EXHAUST FLOW DIAGRAM NON-FILTERED SYSTEM EFFLUENT SYSTEMS DIAGRAM		DRAWN JE SANDBERG CHECKED DJ TEAGER DATE 5/2/91 2 DATE 5/2/91 1 DATE 5/2/91 1 DATE 5/2/91 1		DATE 5/2/91 2 DATE 5/2/91 1 DATE 5/2/91 1		SCALE 40% SHEET 2 OF 8	
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EXHAUST FLOW DIAGRAM

REV. RELEASE 01-17-92 DATE

DRAWING NO.		REV. NO.		DATE		DRAWING TITLE	
NEXT USED ON		REVISED		DATE		DESCRIPTION	
REFERENCE DRAWINGS		REVISIONS		DATE		DESCRIPTION	
CADD CODE 3D:BM.ACD2:12.0:55		CADD CODE C070213C		DATE 12/10/88		BY JNL	
DRAWN BY JE SANDBERG		CHECKED BY DJ YEAGER		DATE 5/2/91		BY JNL	
DESIGNED BY R SCOTT SPENCER		DATE 11/2/88		BY JNL		DATE 11/2/88	
DRAWN BY JN LEEPER		DATE 11/2/88		BY JNL		DATE 11/2/88	
CHECKED BY ER CERK		DATE 11/2/88		BY JNL		DATE 11/2/88	
OTHER		DATE		BY		DATE	
APPROVED FOR SUBMITTAL		DATE		BY		DATE	
FOR PNL		DATE 12/10/88		BY JNL		DATE 12/10/88	

U. S. DEPARTMENT OF ENERGY			
ARCHITECTURAL OPERATIONS OFFICE			
PACIFIC NORTHWEST LABORATORY			
OPERATED BY BATTTELLE MEMORIAL INSTITUTE			
EXHAUST FLOW DIAGRAM			
EFFLUENT SYSTEM DIAGRAMS			
DATE	REV. NO.	DATE	REV. NO.
7001	331	8900	9100
H-3-7021312		SCALE NONE	
SHEET 3 OF 8		REV. NO.

FROM
RM 129 HOODS
SEE SH 3

FROM
RM 151 HOODS
SEE SH 3

FROM
RM 158 HOOD
SEE SH 3

MATCH LINE SEE SH 5

MATCH LINE SEE SH 5

FIRST FLOOR PLAN
SCALE : NONE

LOW DIAGRAM

90-164

U. S. DEPARTMENT OF ENERGY	
RESEARCH OPERATIONS OFFICE	
PACIFIC NORTHWEST LABORATORY	
OPERATED BY BATTELLE MEMORIAL INSTITUTE	
EXHAUST	
FLOW DIAGRAM	
SINGLE-FILTERED SYSTEM	
EFFLUENT SYSTEM DIAGRAMS	
DATE: 5/1/91	BY: J. E. LEPPER
APPROVED FOR: J. W. LEPPER	DATE: 5/1/91
SIZE: 7001	NO. 331
8930	9150
SCALE: NONE	SHEET: 4 OF 8

REV	DATE	BY	CHKD	DESCRIPTION
1	11/1/90	JWL	SOB	PER ECK 90-164-002
2	11/1/90	JWL	SOB	PER ECK 90-164-002
3	11/1/90	JWL	SOB	PER ECK 90-164-002
4	11/1/90	JWL	SOB	PER ECK 90-164-002
5	11/1/90	JWL	SOB	PER ECK 90-164-002
6	11/1/90	JWL	SOB	PER ECK 90-164-002
7	11/1/90	JWL	SOB	PER ECK 90-164-002
8	11/1/90	JWL	SOB	PER ECK 90-164-002
9	11/1/90	JWL	SOB	PER ECK 90-164-002
10	11/1/90	JWL	SOB	PER ECK 90-164-002

REV	DATE	BY	CHKD	DESCRIPTION
1	11/1/90	JWL	SOB	PER ECK 90-164-002
2	11/1/90	JWL	SOB	PER ECK 90-164-002
3	11/1/90	JWL	SOB	PER ECK 90-164-002
4	11/1/90	JWL	SOB	PER ECK 90-164-002
5	11/1/90	JWL	SOB	PER ECK 90-164-002
6	11/1/90	JWL	SOB	PER ECK 90-164-002
7	11/1/90	JWL	SOB	PER ECK 90-164-002
8	11/1/90	JWL	SOB	PER ECK 90-164-002
9	11/1/90	JWL	SOB	PER ECK 90-164-002
10	11/1/90	JWL	SOB	PER ECK 90-164-002

FIRST FLOOR PLAN
SCALE: NONE

RELEASE
OF 25-78
DATE

DRAWING NO.	REV.	DRAWING TITLE	DATE	BY	CHK	APP	DATE	DESCRIPTION
REFERENCE DRAWINGS			REVISIONS					
NEXT USED ON			CADD CODE 3D1B-WAC02.13.0.55					

U. S. DEPARTMENT OF ENERGY RICKLAND OPERATIONS OFFICE		ECP 1 90-164	
PACIFIC NORTHWEST LABORATORY OPERATED BY BATTELLE MEMORIAL INSTITUTE			
EXHAUST FLOW DIAGRAM ROOM 152			
EFFLUENT SYSTEM DIAGRAMS			
DATE 10/17/78	BY K. S. KOSCHIK	REV. 7001	331
APPROVED FOR BY J. L. GASTON	DATE 10/24/78	SCALE NONE	HEET 5 OF 5
CADD CODE 3D1B-WAC02.13.0.55		CADD CODE C070213H

T FLOW DIAGRAM

DRAWING NO.	REV.	DATE	DESCRIPTION
1	1	11/1/94	ISSUED FOR CONSTRUCTION
2	1	11/1/94	ISSUED FOR CONSTRUCTION
3	1	11/1/94	ISSUED FOR CONSTRUCTION
4	1	11/1/94	ISSUED FOR CONSTRUCTION
5	1	11/1/94	ISSUED FOR CONSTRUCTION
6	1	11/1/94	ISSUED FOR CONSTRUCTION
7	1	11/1/94	ISSUED FOR CONSTRUCTION
8	1	11/1/94	ISSUED FOR CONSTRUCTION
9	1	11/1/94	ISSUED FOR CONSTRUCTION
10	1	11/1/94	ISSUED FOR CONSTRUCTION

REV.	DATE	BY	CHKD.	DATE	DESCRIPTION
1	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
2	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
3	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
4	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
5	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
6	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
7	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
8	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
9	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION
10	11/1/94	JWL	SDB	11/1/94	ISSUED FOR CONSTRUCTION

U. S. DEPARTMENT OF ENERGY	DATE: 11/1/94
PACIFIC NORTHWEST LABORATORY	DATE: 11/1/94
OPERATED BY BATTELLE MEMORIAL INSTITUTE	DATE: 11/1/94
EXHAUST FLOW DIAGRAM	DATE: 11/1/94
DOUBLE-FILTERED SYSTEM	DATE: 11/1/94
EFFLUENT SYSTEM DIAGRAMS	DATE: 11/1/94
REV. 1	DATE: 11/1/94
REV. 2	DATE: 11/1/94
REV. 3	DATE: 11/1/94
REV. 4	DATE: 11/1/94
REV. 5	DATE: 11/1/94
REV. 6	DATE: 11/1/94
REV. 7	DATE: 11/1/94
REV. 8	DATE: 11/1/94
REV. 9	DATE: 11/1/94
REV. 10	DATE: 11/1/94

W DIAGRAM

FIRST FLOOR PLAN
SCALE: NONE

90-164

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REVISIONS 1. PER ECH 90-164-002 RUND REVISION CONTROL BLOCK DATE 11/1/81 BY J. SANDBERG CHECKED BY J. SANDBERG APPROVED BY J. SANDBERG DATE 11/1/81				EXHAUST FLOW DIAGRAM NORTH WING EFFLUENT SYSTEM DIAGRAMS			
DRAWING NO. 7 DATE 11/1/81 BY J. SANDBERG CHECKED BY J. SANDBERG APPROVED BY J. SANDBERG DATE 11/1/81				H-3-7021313 SCALE NONE SHEET 7 OF 8

FIRST FLOOR PLAN
SCALE : NONE

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REVIEWER		DATE		PACIFIC NORTHWEST LABORATORY	
JL GASTON		1/24/98		OPERATED BY BATTTELLE MEMORIAL INSTITUTE	
ER GERK		1/24/98			
OTHER					
VINH NGUYEN		1/24/98			
APPROVED FOR IMPLEMENTATION		BY		DATE	
JL GASTON		1/24/98			
FOR PNNL		DATE 8/24/98			
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